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U.S. Department
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Federal Aviation
Administration

U.S. DEPARTMENT of TRANSPORTATION

Federal Aviation Administration

Interface Requirements Document (DRAFT)

National Air Space (NAS) Voice System (NVS) to
Radio Subsystems

INTERFACE REQUIREMENTS DOCUMENTS
APPROVAL SIGNATURE PAGE

National Air Space (NAS) Voice System (NVS) to Radio Subsystems

APPROVAL SIGNATURES		
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REVISION RECORD

REVISION LETTER	DESCRIPTION	DATE	ENTERED BY

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1. SCOPE

1.1 Summary

This Interface Requirements Document (IRD) is prepared in accordance with the standards and requirements contained in FAA-STD-025 and FAA-STD-067. The IRD provides the requirements for the interfaces between the National Airspace System (NAS) Voice System (NVS) and Radio Subsystems. The Radio Subsystems covered in this IRD consists of radios, Remote Radio Nodes (RRNs) and Radio Control Equipment (RCE).

The contractor (vendor) will capture the design characteristics of the NVS to Radio Subsystems interface in the Interface Control Document (ICD).

Section 2, Applicable Documents, lists the reference documents used in developing this IRD.

Section 3, Interface Requirements, defines the interfaces in terms of their general, functional, and physical characteristics.

Section 4, Quality Assurance Provisions, defines the Quality Assurance provisions for this IRD.

Section 5, Preparation for Delivery, is not applicable in this IRD.

Section 6, Notes, contains definitions, abbreviations and acronyms used in this IRD.

1.2 Subsystem Responsibility List

TABLE 1-1 System Equipment Responsibility

Subsystem/Equipment	Common Name	Responsible Organization
NVS	NAS Voice System	AJW-9281
RCE	Radio Control Equipment	AJW-9282
AVN	ATC Voice Node	AJW-9281
RRN	Remote Radio Node	AJW-9281
A/G Radios	Air-to-Ground Radios	AJW-9282

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2. APPLICABLE DOCUMENTS

The following documents form a part of this IRD to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this IRD, the contents of this IRD **must** be the superseding requirements.

2.1 Government Documents

2.1.1 Federal Aviation Administration Documents

2.1.1.1 Standards

FAA-STD-025f	Preparation of Interface Documentation, November 30, 2007
FAA-STD-067	Preparation of Specifications December 4, 2009

2.1.1.2 Handbooks

FAA-HDBK-002	Open Systems Management June 27, 1997

2.1.1.3 Specifications

FAA-E-NVS	Federal Aviation Administration Procurement Specification, National Airspace System (NAS) Voice System (NVS) Draft
FAA-E-2885	Radio Control Equipment June 17, 2009
FAA-G-2100H	Electronic Equipment, General Requirements May 9, 2005
FAA-P-2883	Purchase Description, VHF/UHF Air/Ground Radio Communications Receivers, April 14, 1994
FAA-P-2884	Purchase Description, VHF/UHF Air/Ground Radio Communications Transmitters, April 14, 1994
FAA-E-2938	Subsystem Specification -Multi-Mode Digital Radio MDR, July 23, 2001, V4.0
FAA-P-2956	CM-300

2.1.1.4 FAA Orders

None

2.1.1.5 Other FAA Documents

FTI Operational Network IP Users Guide, Revision 2C, March 2010

NAS-IR-xxxxxxxx NVS/FTI Interface Requirements Document
Draft

2.1.2 Military Documents

None

2.2 Non-Government Documents

2.2.1 Standards

EUROCAE ED-137 Part 1 — Interoperability Standards for VoIP ATM Components, Part 1: Radio
May 2010

TIA-232F — Interface between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange,
October 11, 2002

2.2.2 Technical Instruction Books

TI 6650.48A — Radio Control Equipment, Model CS-2330/RCE System Manual
September 21, 2004

2.2.3 Other Publications

RFC 791 — Internet Protocol, IPv4
September 1981

RFC 2460 — Internet Protocol, IPv6
December 1998

IEEE 802.3 — Local Area Networks: Carrier sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specification.
1998

2.3 Document Sources

2.3.1 Source of FAA Documents

Copies of FAA specifications, standards, and publications may be obtained from the Contracting Officer, Federal Aviation Administration, 800 Independence Avenue, S.W., Washington, D.C., 20591. Requests should clearly identify the desired material by number and date, and state the intended use of the material.

2.3.2 EIA

Copies of Electronic Industries Alliance (EIA) standards may be obtained from the Electronic Industries Alliance, 2500 Wilson Boulevard, Arlington, VA 22201-3834, or by calling (703) 907-7500, or via the Web at http://global.ihs.com/help.cfm?rid=ECA.

2.3.3 EUROCAE Documents

EUROCAE documents can be purchased via the Web at http://boutique.eurocae.net/catalog/index.php. Special requests for printed copies should be made via e-mail to marie.potez@eurocae.net, or via telephone at +33 1 40 92 79 30.

2.3.4 IEEE/ANSI Documents

Copies of Institute of Electrical and Electronics Engineers (IEEE) documents may be requested as follows: by mail at IEEE Customer Service, 445 Hoes Lane, Piscataway, NJ 08854-4141; by phone (800) 701-4333 (in the United States and Canada) or (732) 981-0060 (outside the United States and Canada); or via the following Web site: http://www.ieee.org/web/standards/home/index.html. The American National Standards Institute (ANSI) Web site is located at http://www.ansi.org.

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3. INTERFACE REQUIREMENTS

3.1 General Requirements

This IRD describes the interface requirements between the NVS and the Radio Subsystems utilized by the Federal Aviation Administration (FAA) for Air-to-Ground (A/G) communications. As depicted in Figure 3-1, there are six configurations in which the NVS has external interfaces associated with radios and radio control equipment. Two additional interfaces are shown in Figure 3-1 that supports an existing Radio Control Equipment (RCE) data pass-through for Remote Monitoring and Control. Figure 3-1 also shows how the FAA Communications Network provides the transport and physical interface for the R-RCE, Networked Radio, and C-RCE external interfaces. When the FAA Communications Network services are utilized, the NVS transport and physical interface will be specified by the NVS to FAA Telecommunications Infrastructure (FTI) IRD.

a. The ATC Voice Node (AVN) **must** provide Local Radio interfaces to transmit and receive voice and radio control signals.

b. The AVN **must** provide Remote RCE (R-RCE) interfaces to transmit and receive voice and radio control signals.

c. The AVN **must** provide Remote Monitoring and Control interfaces to transmit and receive data with the R-RCE.

d. The RRN **must** provide Control RCE (C-RCE) interfaces to transmit and receive voice and radio control signals.

e. The RRN **must** provide Legacy A/G radio interfaces to transmit and receive voice and radio control signals.

f. The RRN **must** provide Remote Monitoring and Control interfaces to transmit and receive data with the C-RCE.

g. The AVN **must** provide Networked Radio interfaces to transmit and receive voice and radio control signals.

h. The RRN **must** provide Networked Radio interfaces to transmit and receive voice and radio control signals.

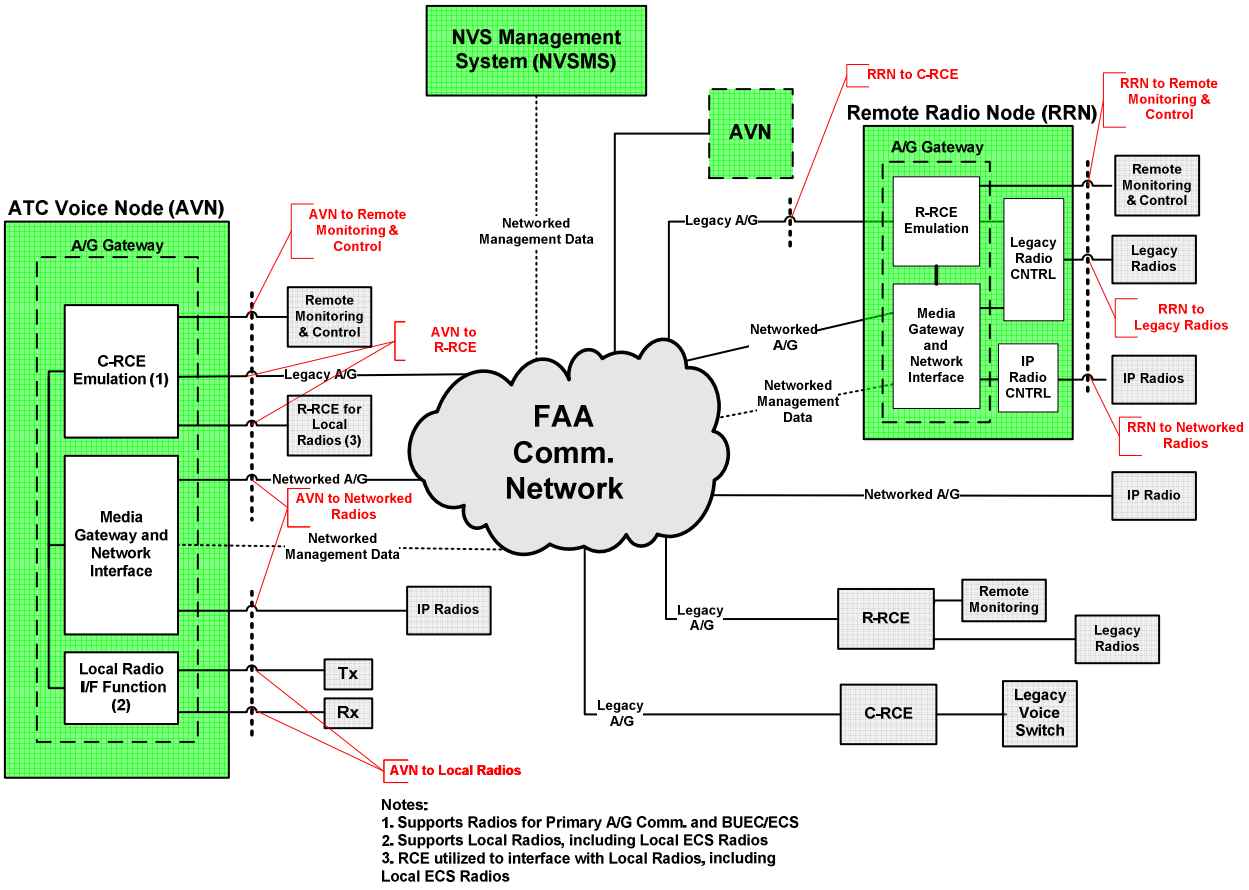

FIGURE 3-1 NVS / Radio Subsystems Functional Interfaces

3.2 Functional Requirements

The following sections define the requirements for each of the interfaces identified in Figure 3-1.

3.2.1 AVN to Local Radio Interface

This section summarizes the characteristics of the AVN to Local Radio interface. The local radios defined in this section are radios at the same facility as the AVN and allows for a direct connection of the AVN to the radios. Some variation by site of the Local Radio interface can be expected and complete details will be specified by the government at time of order.

Figure 3-2 summarizes the functional interface between the AVN and local radios. Depending on the FAA radios being utilized, a subset of the signaling shown in Figure 3-2 may be required.

Two types of interfaces are required for the local radios. One type utilizes FAA supplied voltage (+48 volts direct current (VDC)) for signaling. The other type interface utilizes contact closure for battery (+24 and +48 VDC) and ground loop back signaling.

Table 3-1 lists the set of operational functions for the AVN / Local Radio interface.

a. The AVN **must** utilize FAA provided +48 VDC as specified in section 3.3.1.1 for control of local radios.

b. The AVN **must** provide +24 VDC, as directed at time of order, to the local radio demarcation frame as specified in section 3.3.1.2.

c. The AVN **must** provide +48 VDC, as directed at time of order, to the local radio demarcation frame as specified in section 3.3.1.2.

d. The AVN **must** provide a ground signal to the local radio demarcation frame as specified in section 3.3.1.2.

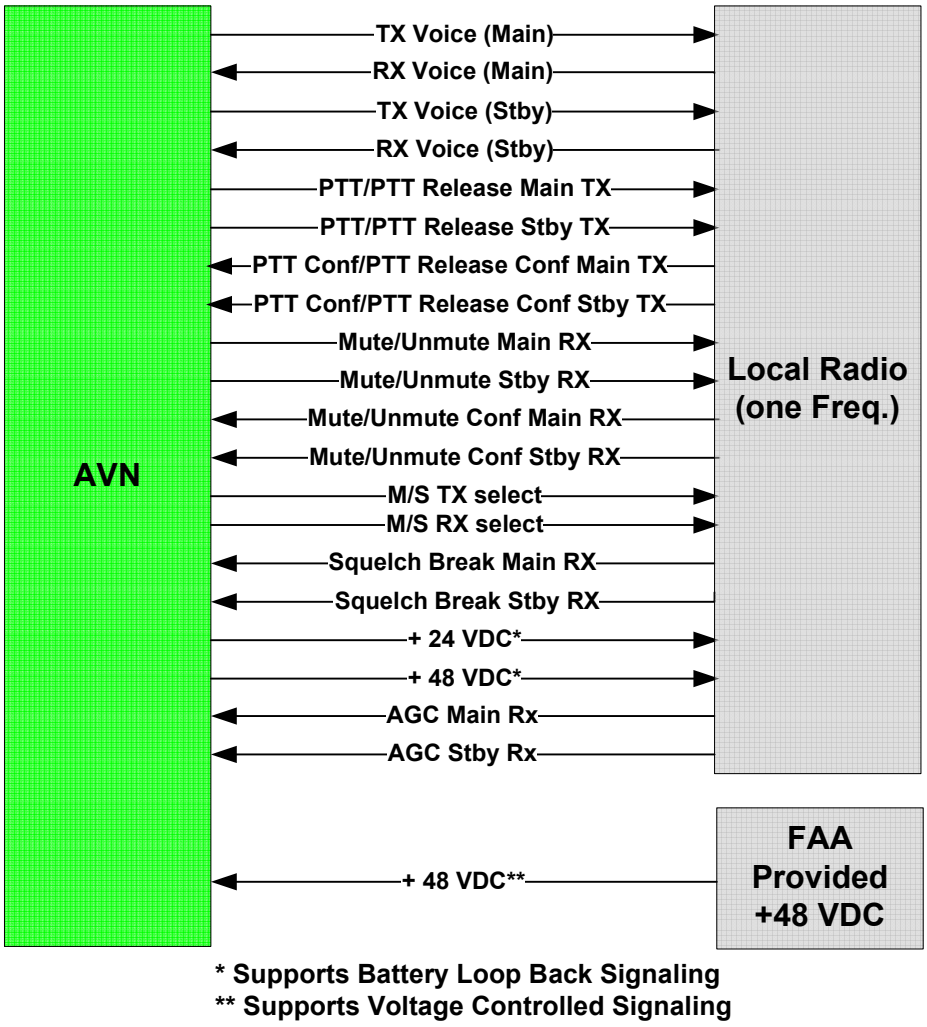

FIGURE 3-2 AVN / Local Radio Functional Interface

TABLE 3-1 Discrete and Analog Signal Functions for AVN / Local Radio Interface

FUNCTION	SOURCE	DESTINATION	DESCRIPTION
TX Voice (Main)	AVN	Local Radio	Voice to the main transmitter
RX Voice (Main)	Local Radio	AVN	Voice from the main receiver
TX Voice (Stby)	AVN	Local Radio	Voice to the standby transmitter
RX Voice (Stby)	Local Radio	AVN	Voice from the standby receiver
PTT/PTT Release Main TX	AVN	Local Radio	Keys/unkeys the main transmitter
PTT/PTT Release Stby TX	AVN	Local Radio	Keys/unkeys the standby transmitter
PTT/PTT Release Conf Main TX	Local Radio	AVN	Confirms that Main TX PTT/PTT release signal was received from AVN
PTT/PTT Release Conf Stby TX	Local Radio	AVN	Confirms that Stby TX PTT/PTT release signal was received from AVN
Mute/Unmute Main RX	AVN	Local Radio	Mutes/unmutes the main receiver
Mute/Unmute Stby RX	AVN	Local Radio	Mutes/unmutes the standby receiver
Mute/Unmute Conf Main RX	Local Radio	AVN	Confirms main receiver muted/unmuted
Mute/Unmute Conf Stby RX	Local Radio	AVN	Confirms standby receiver muted/unmuted
M/S TX Select	AVN	Antenna Transfer Relay	Selects main/standby transmitter
M/S RX Select	AVN	Antenna Transfer Relay	Selects main/standby receiver
Squelch Break Main RX	Local Radio	AVN	Indicates audio present on main receiver.
Squelch Break Stby RX	Local Radio	AVN	Indicates audio present on standby receiver.
AGC Main Rx	Local Radio	AVN	Passes the AGC signal from the radio to the AVN.

FUNCTION	SOURCE	DESTINATION	DESCRIPTION
AGC Stby Rx	Local Radio	AVN	Passes the AGC signal from the radio to the AVN.

3.2.1.1 Local Radio Audio

a. The AVN **must** provide a two-wire interface that provides a transmitter (TX) audio signal to each local transmitter comprising the radio frequency interface (i.e., main transmitter and standby transmitter.

b. The AVN **must** provide a two-wire TX audio interface that is transformer coupled with an impedance of 600 ohms ± 10% to each local transmitter.

c. The AVN **must** provide a two-wire TX audio interface at a level of -8dBm that is adjustable ± 8 dB (test tone level) to each local transmitter.

d. The AVN **must** provide a two-wire TX audio interface with a nominal 600 ohm center tapped transformer arrangement capable of passing up to 60 mA DC current in support of simplex PTT keying.

e. The AVN **must** provide a two-wire TX audio interface that has a frequency response of 300 to 3,000 Hz +/- 1 dB to each local transmitter.

f. The AVN **must** provide a two-wire interface that accepts a receiver (RX) audio signal from each local receiver comprising the radio frequency interface (i.e., main receiver and standby receiver).

g. The AVN **must** provide a two-wire RX Audio interface that is transformer coupled with an impedance of 600 ohms ± 10% to each local receiver.

h. The AVN **must** provide a two-wire interface that accepts an RX audio signal from each local receiver at a level of -8dBm, adjustable ± 8 dB (test tone level).

i. The AVN **must** provide a two-wire RX Audio interface that has a frequency response of 300 to 3,000 Hz +/- 1 dB to each local receiver.

j. The AVN **must** provide two-wire pairs that are transformer coupled, balanced, and isolated from ground for both the TX and RX interfaces to the Local Radio.

3.2.1.2 Voltage Controlled Local Radio Interface Characteristics

The following sections describe the interface characteristics for voltage controlled local radios in which the AVN will utilize FAA provided +48 VDC.

3.2.1.2.1 Push-to-Talk (PTT)/PTT Release

a. The AVN **must** provide a positive voltage to the PTT inputs of main and standby transmitters to activate PTT.

b. The AVN **must** provide an open circuit to the PTT inputs of main and standby transmitters to deactivate PTT.

c. The AVN **must** meet the output parameters for the PTT interface of main and standby transmitters as specified in Table 3-2**.**

TABLE 3-2 AVN Output Parameters for PTT Interface

Function	Voltage	Current
PTT	48 VDC ± 10%	60 mA max.
PTT Release	Open Circuit	100 uA max. leakage current

3.2.1.2.2 Main/Standby (M/S) Transmitter Select

a. The AVN **must** provide a positive voltage to the main/standby (M/S) transmitter select inputs for the selection of standby transmitter.

b. The AVN **must** provide an open circuit to the M/S transmitter inputs for the selection of main transmitter.

c. The AVN **must** meet the output parameters for selection of M/S transmitters as specified in Table 3-3.

TABLE 3-3 AVN Output Parameters for M/S Selection of Transmitters

Function	Voltage	Current
Stby TX	48 VDC ± 10%	60 mA max.
Main TX	Open Circuit	100 uA max. leakage current

3.2.1.2.3 Main/Standby (M/S) Receiver Select

a. The AVN **must** provide a positive voltage to the M/S receiver select inputs for the selection of standby receiver.

b. The AVN **must** provide an open circuit to the M/S receiver select inputs for the selection of main receiver.

c. The AVN **must** meet the output parameters for selection of M/S receivers as specified in Table 3-4.

TABLE 3-4 AVN Output Parameters for M/S Selection of Receivers

Function	Voltage	Current
Stby RX	48 VDC ± 10%	60 mA max.
Main RX	Open Circuit	100 uA max. leakage current

3.2.1.3 Contact Closure Controlled Local Radio Interface Characteristics

The following sections describe the interface characteristics for contact closure controlled local radios. As shown in Figure 3.3, contact closure will be utilized to control local radios by

providing options for looping back both battery (+24 and +48 VDC) and ground for control of local radios.

a. The AVN **must** provide the option for battery loop back control of local radios as shown in Figure 3-3.

b. The AVN **must** provide the option for ground loop back control of local radios as shown in Figure 3-3.

c. The AVN **must** provide the option for simplex keying of local radios as shown in Figure 3-3.

d. The AVN **must** provide the option for both Normally Open (NO) and Normally Closed (NC) relay contacts to control local radios.

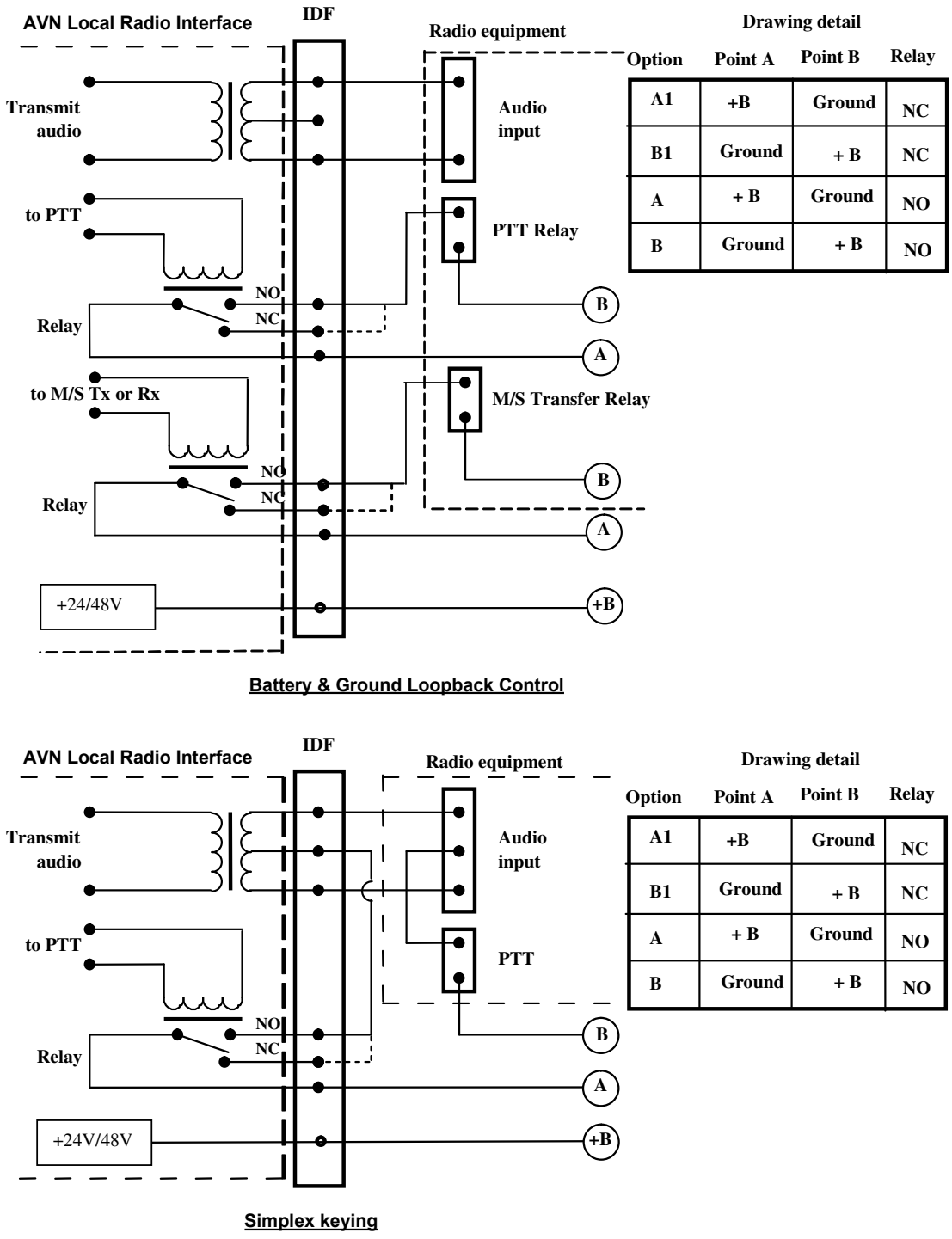

FIGURE 3-3 Typical AVN / Local Radio Contact Closure Control Circuits

3.2.1.3.1 Push-to-Talk (PTT)/PTT Release

a. The AVN **must** provide a relay contact closure to the PTT inputs of main and standby transmitters to activate PTT.

b. The AVN **must** provide an open relay contact to the PTT inputs of main and standby transmitters to deactivate the PTT feature.

c. The AVN **must** meet the parameters for the PTT interface of main and standby transmitters as specified in Table 3-5.

TABLE 3-5 AVN Parameters for PTT Interface

Function	Relay State	Contact Voltage	Contact Current	Contact Resistance
PTT	Contacts closed	N/A	60 mA max.	10 ohms max.
PTT Release	Contacts open	60 VDC max.	100 uA max. leakage current	10 Mega ohm min.

3.2.1.3.2 Receiver Mute/Unmute

a. The AVN **must** provide a relay contact closure to the Mute/Unmute inputs of main and standby receivers to mute the receiver.

b. The AVN **must** provide an open relay contact to the Mute/Unmute inputs of main and standby receivers to deactivate the receiver mute feature.

c. The AVN **must** meet the parameters for the Mute/Unmute interface of main and standby receivers as specified in Table 3-6.

TABLE 3-6 AVN Parameters for Receiver Mute

Function	Relay State	Contact Voltage	Contact Current	Contact Resistance
Receiver Mute	Contacts closed	N/A	60 mA max.	10 ohms max.
Receiver Unmute	Contacts open	60 VDC max.	100 uA max. leakage current	10 Mega ohm min.

3.2.1.3.3 Main/Standby (M/S) Transmitter Select

a. The AVN **must** provide a relay contact closure to the M/S transmitter select inputs for the selection of standby transmitter.

b. The AVN **must** provide an open relay contact to the M/S transmitter select inputs for the selection of main transmitter.

c. The AVN **must** meet the parameters for selection of M/S transmitters as specified in Table 3-7.

TABLE 3-7 AVN Parameters for M/S Selection of Transmitters

Function	Relay State	Contact Voltage	Contact Current	Contact Resistance
Stby TX	Contacts closed	N/A	60 mA max.	10 ohms max.
Main TX	Contacts open	60 VDC max.	100 uA max. leakage current	10 Mega ohm min.

3.2.1.3.4 Main/Standby (M/S) Receiver Select

a. The NVS **must** provide a relay contact closure to the M/S receiver select inputs for the selection of standby receiver.

b. The NVS **must** provide an open relay contact to the M/S receiver select inputs for the selection of main receiver.

c. The NVS **must** meet the parameters for selection of M/S receivers as specified in Table 3-8.

TABLE 3-8 AVN Parameters for M/S Selection of Receivers

Function	Relay State	Contact Voltage	Contact Current	Contact Resistance
Stby RX	Contacts closed	N/A	60 mA max.	10 ohms max.
Main RX	Contacts open	60 VDC max.	100 uA max. leakage current	10 Mega ohm min.

3.2.1.4 Contact Closure Inputs from Local Radio Interface

The following sections describe the interface characteristics for contact closure inputs that may be provided by the local radios. These inputs would be provided directly from the radio and consist of confirmation and squelch break signaling.

3.2.1.4.1 Push-to-Talk (PTT)/PPT Release Confirmation

a. The AVN **must** accept a contact closure from the main and standby transmitter PTT confirmation outputs to indicate an activate PTT status.

b. The AVN **must** accept an open contact from the main and standby transmitter PTT confirmation outputs to indicate an inactivate PTT status.

c. The AVN **must** meet the parameters for the main and standby transmitter PTT confirmation interface as specified in Table 3-9.

TABLE 3-9 AVN Parameters for Transmitter PTT Confirmation

Function	State	AVN Supplied Voltage	AVN Supplied Current	Contact Resistance
PTT Confirmation	Contacts closed	N/A	60 mA max.	10 ohms max.
PTT Release Confirmation	Contacts open	60 VDC max.	N/A	1 Mega ohm min.

3.2.1.4.2 Receiver Mute Confirmation

a. The AVN **must** accept a contact closure from the main and standby receiver Mute confirmation outputs to indicate receiver is muted.

b. The AVN **must** accept an open contact from the main and standby receiver Mute confirmation outputs to indicate receiver is not muted.

c. The AVN **must** meet the parameters for the main and standby receiver Mute confirmation interface as specified in Table 3-10.

TABLE 3-10 AVN Parameters for Receiver Mute Confirmation

Function	State	AVN Supplied Voltage	AVN Supplied Current	Contact Resistance
Receiver Muted	Contacts closed	N/A	60 mA max.	10 ohms max.
Receiver Not muted	Contacts open	60 VDC max.	N/A	1 Mega ohm min.

3.2.1.4.3 Receiver Squelch Break

a. The AVN **must** accept a contact closure from the main and standby receiver Squelch Break outputs to indicate an activate Squelch Break.

b. The AVN **must** accept an open contact from the main and standby receiver Squelch Break outputs to indicate an inactivate Squelch Break.

c. The AVN **must** meet the parameters for the main and standby receiver Squelch Break interface as specified in Table 3-11.

TABLE 3-11 AVN Parameters for Receiver Squelch Break

Function	State	RRN Supplied Voltage	RRN Supplied Current	Contact Resistance
Audio Present	Contacts closed	N/A	60 mA	10 ohms max.
Audio Not Present	Contacts open	60 VDC	N/A	1 Mega ohm min.

3.2.1.4.4 Automatic Gain Control (AGC) Voltage from the A/G Radio Interface

a. The AVN **must** accept a voltage from the main and standby receiver AGC outputs to indicate that audio level.

b. The AVN **must** meet the input parameters for the receiver AGC signal outputs as specified in Table 3-12.

TABLE 3-12 AVN Input Parameters for Receiver AGC Voltage

Function	Nominal Voltage	Nominal Current
AGC Signal Levels	0 to 10 VDC	0.5 mA max (sink)

3.2.2 AVN to R-RCE Interface

This section summarizes the characteristics of the AVN (C-RCE Emulation) to the R-RCE interface. Figure 3-4 shows an overall functional block diagram of the radio communications subsystems and identifies the AVN to R-RCE interface. Figure 3-5 summarizes the functional interface between the AVN and the R-RCE.

The AVN / R-RCE signal functions for the four-wire interface are provided in Table 3-13.

The AVN will emulate the C-RCE function and communicate with the existing R-RCE over a four-wire Telco line.

a. The AVN **must** interface with the R-RCE over a single four-wire voice grade (VG-6) transmission path.

b. The AVN **must** provide a physical interface to the R-RCE in accordance with the NVS to FTI IRD.

c. The AVN **must** provide an interface (channel) to the R-RCE for two radio frequencies to utilize one four-wire transmission path.

d. The AVN **must** provide an interface (channel) to the R-RCE that supports the capability to transmit and receive voice and radio control signals for up to two related A/G frequencies over a single four-wire voice grade transmission path.

e. The NVS **must** provide monitoring, maintenance and configuration of the R-RCE over the same single four-wire voice grade interface used for voice and radio control signals.

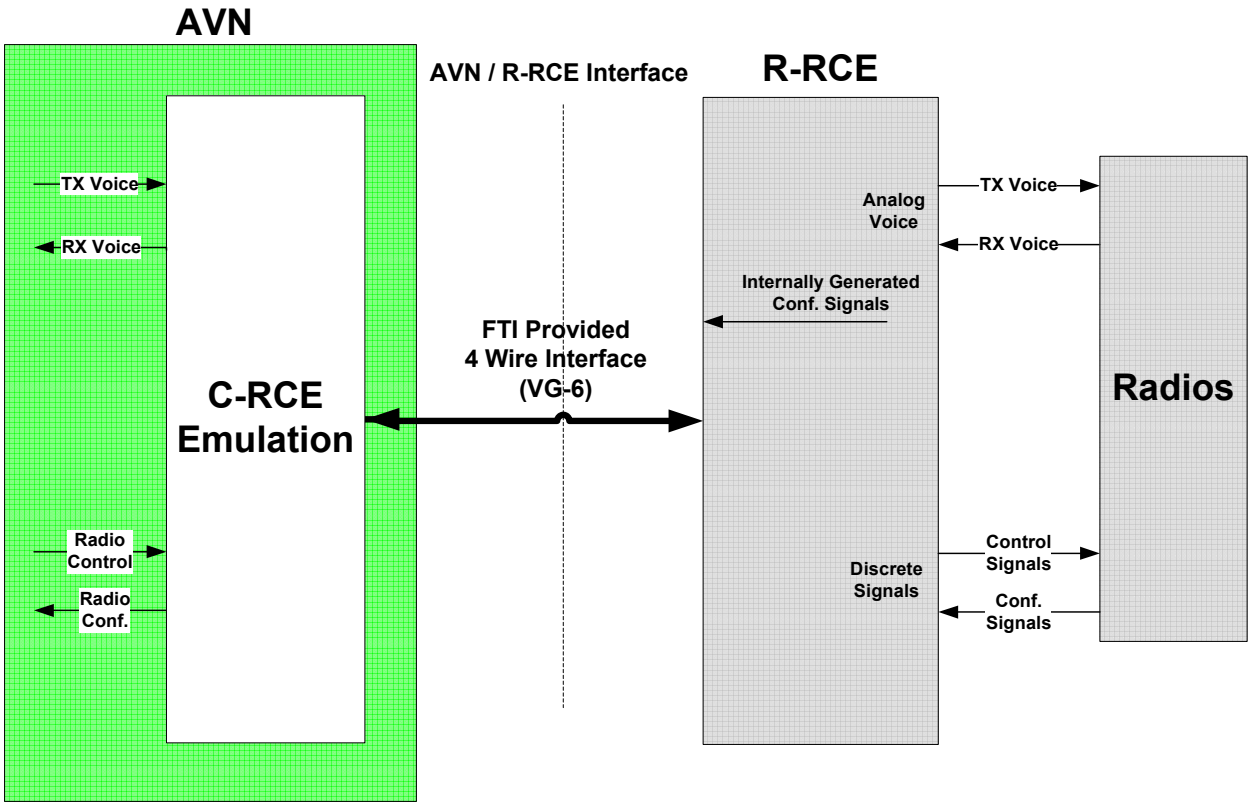

FIGURE 3-4 AVN / R-RCE Operational Functions

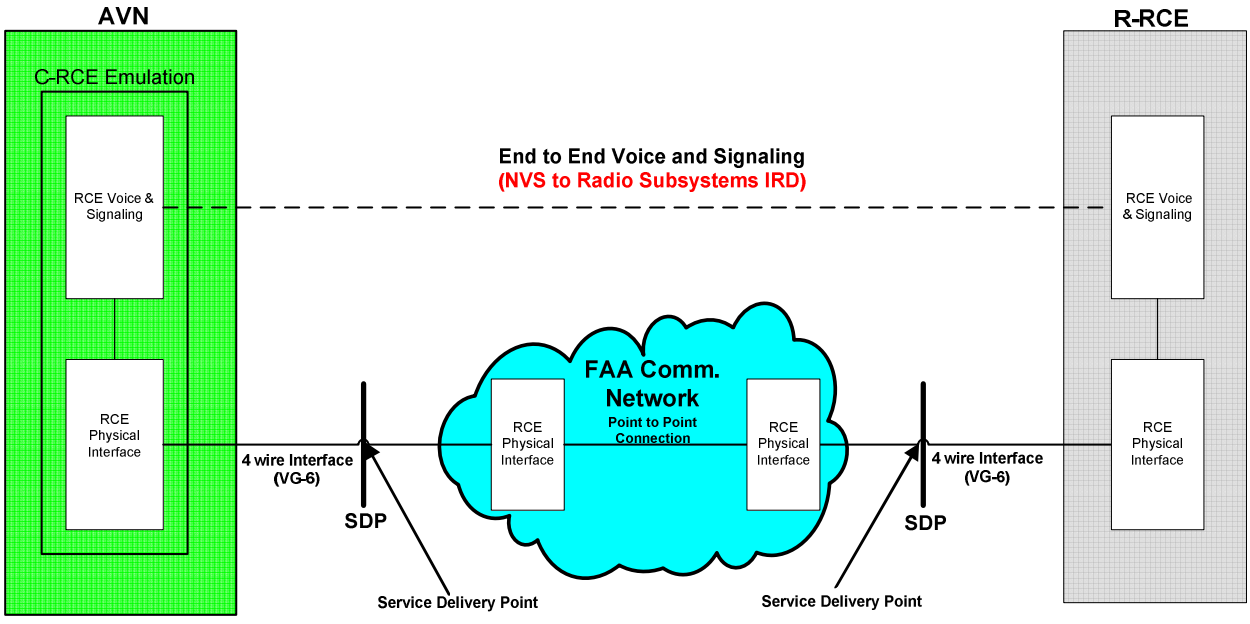

FIGURE 3-5 AVN / R-RCE Functional Interface

TABLE 3-13 Signal Functions for the AVN / R-RCE Interface

FUNCTION	SOURCE	DESTINATION	DESCRIPTION
TX Voice	AVN	R-RCE	Voice to the transmitters
RX Voice	R-RCE	AVN	Voice from the receivers
PTT/PTT Release Freq. 1	AVN	R-RCE	Keys/unkeys the freq. 1 transmitter
PTT/PTT Release Freq. 2	AVN	R-RCE	Keys/unkeys the freq. 2 transmitter
PTT Confirm/PTT Release Confirm Freq. 1	R-RCE	AVN	Confirms that freq. 1 PTT/PTT release signal was received from NVS
PTT Confirm/PTT Release Confirm Freq. 2	R-RCE	AVN	Confirms that freq. 2 PTT/PTT release signal was received from NVS
RX Mute/Unmute Freq. 1	AVN	R-RCE	Mutes/unmutes the freq. 1 receiver (RX)
RX Mute/Unmute Freq. 2	AVN	R-RCE	Mutes/unmutes the freq. 2 receiver (RX)
Mute/Unmute Confirm Freq. 1	R-RCE	AVN	Confirms freq. 1 receiver muted/unmuted
Mute/Unmute Confirm Freq. 2	R-RCE	AVN	Confirms freq. 2 receiver muted/unmuted
M/S TX Select Freq. 1	AVN	R-RCE	Selects main/standby (M/S) freq. 1 transmitter (TX)
M/S TX Select Freq. 2	AVN	R-RCE	Selects main/standby (M/S) freq. 2 transmitter (TX)
M/S TX Select Confirm Freq. 1	R-RCE	AVN	Verifies selection of main/standby (M/S) freq. 1 transmitter (TX)
M/S TX Select Confirm Freq. 2	R-RCE	AVN	Verifies selection of main/standby (M/S) freq. 2 transmitter (TX)
M/S RX Select Freq. 1	AVN	R-RCE	Selects main/standby (M/S) freq. 1 receiver (RX)

FUNCTION	SOURCE	DESTINATION	DESCRIPTION
M/S RX Select Freq. 2	AVN	R-RCE	Selects main/standby (M/S) freq. 2 receiver (RX)
M/S RX Select Confirm Freq. 1	R-RCE	AVN	Verifies selection of main/standby (M/S) freq. 1 receiver (RX)
M/S RX Select Confirm Freq. 2	R-RCE	AVN	Verifies selection of main/standby (M/S) freq. 2 receiver (RX)
Squelch Break Freq. 1	R-RCE	AVN	Indicates audio present on receiver (RX) freq. 1
Squelch Break Freq. 2	R-RCE	AVN	Indicates audio present on Receiver (RX) freq. 2
Frequency Lockout Freq. 1	R-RCE	AVN	In a dual control site, it indicates that the other site's controller is transmitting on that frequency.
Frequency Lockout Freq. 2	R-RCE	AVN	In a dual control site, it indicates that the other site's controller is transmitting on that frequency.
AGC Freq. 1	R-RCE	AVN	Indicates Signal Strength from receiver for freq. 1
AGC Freq. 2	R-RCE	AVN	Indicates Signal Strength from receiver for freq. 2

3.2.2.1 AVN / R-RCE Trunk Interfaces

The AVN will provide four, four-wire trunk interfaces to support different control modes of the R-RCE. Each trunk interface consists of a two-wire pair for TX and a two-wire pair for RX. Figure 3-6 depicts how the AVN four-wire (TX and RX) interfaces to the R-RCE supports the Separated TX and RX Configuration, Primary and Backup Configuration, and Dual Control Configuration.

a. The AVN **must** provide the four-wire interfaces as depicted in Figure 3-6 for the three legacy operational configurations with the R-RCE.

b. The AVN **must** be configurable to support, at a minimum, two active and two standby four-wire interfaces per RCE channel.

c. The AVN **must** provide four-wire interfaces to the R-RCE channel that are transformer coupled with an impedance of 600 ohms ± 10%.

d. The AVN **must** provide two-wire TX audio interfaces to the R-RCE that are adjustable over the range of -40 dBm to +7 dBm (test tone level).

e. The AVN **must** provide two-wire RX audio interfaces with adjustable gain to receive audio from the R-RCE over the range of -40 dBm to +7 dBm (test tone level).

f. The AVN **must** provide independent level control of the data modem and voice signals over the R-RCE four-wire interface.

g. The AVN **must** provide four-wire interfaces to the R-RCE channels that have a frequency response of 300 to 3,000 Hz +/- 1 dB.

h. The AVN **must** provide four-wire interfaces to the R-RCE channels that have a surge protection of 400 Volts and 100A.

3.2.2.2 AVN RS-232 Pass-Through Interface

The AVN will provide pass-through RS-232 interfaces with the R-RCE for remote monitoring and control as was shown in Figure 3-1. Figure 3-6 depicts how each of the operational configurations provides an RS-232 port function for data.

a. The AVN **must** provide C-RCE emulation that supports pass-through asynchronous interfaces with the R-RCE in accordance with TIA-232.

b. The AVN **must** provide pass-through RS-232 interfaces as depicted in the three operational configurations shown in Figure 3-6.

c. The RRN **must** provide three (3) RS-232 ports.

d. The RRN **must** provide baud rate range of 150 to 9600 baud.

e. The RRN **should** provide baud rate of 19,200 baud or more.

f. The RRN **must** be selectable to even, odd, or none parity.

g. The RRN **must** be selectable for 7 or 8 bit blocks.

h. The RRN **must** be selectable for 1 or 2 stop bits.

i. The RRN **must** be selectable hardware or none for handshaking.

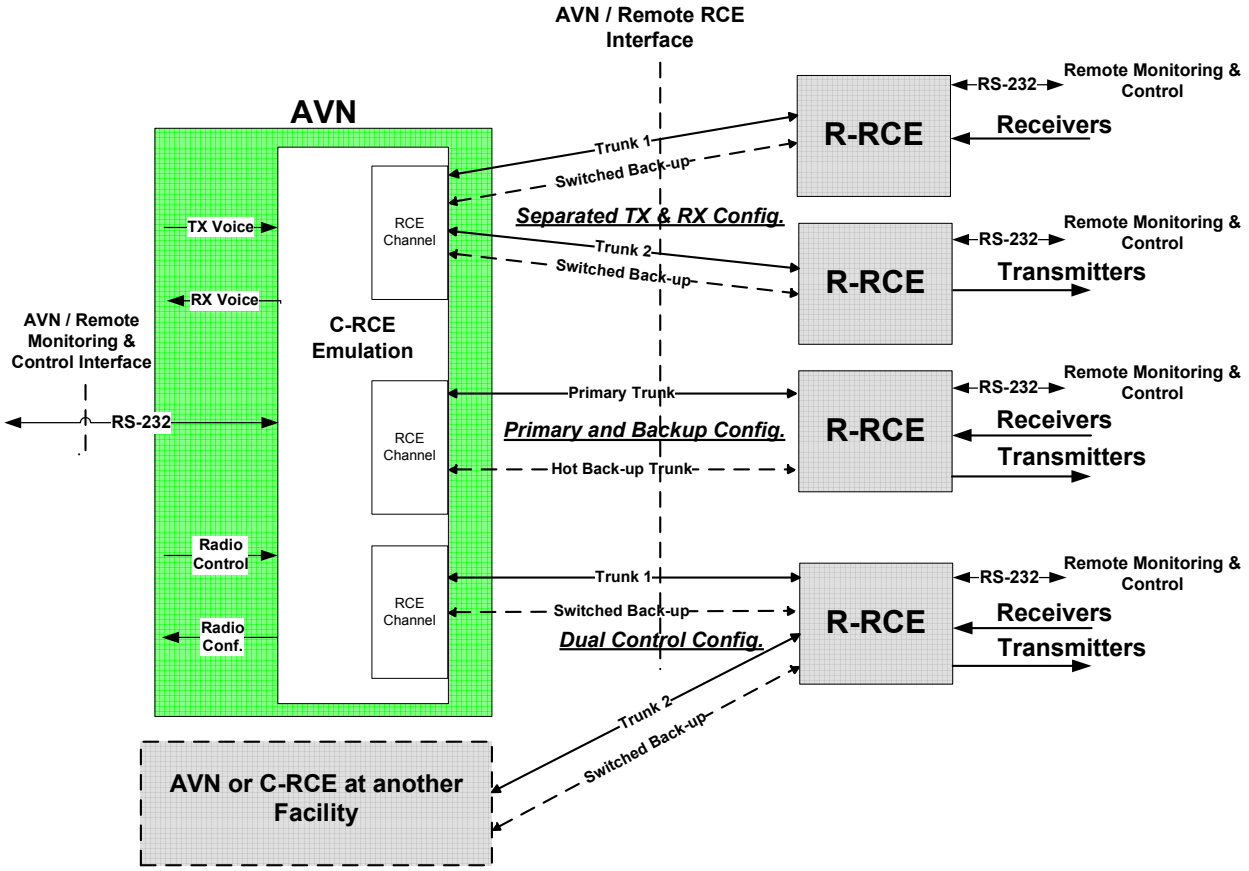

FIGURE 3-6 AVN / R-RCE Four-Wire Interface Configurations

3.2.2.3 AVN / R-RCE Split Voice and Data Configuration

The AVN will provide RCE interfaces that support a Split Voice/Data option for the three legacy operational configurations covered in section 3.2.2.1. Figure 3-7 depicts how each of the operational configurations utilizes the Telco port for voice and an RS-232 port for data. Note that backup trunks to the R-RCE will only be available in the "Primary and Backup Configuration".

a. The AVN **must** support the RCE Split Voice/Data interfaces in which the Telco port will contain only voice and data is routed out of an RS-232 port.

b. The AVN **must** provide asynchronous interfaces for the data port with the R-RCE in accordance with TIA-232.

c. The AVN **must** provide the RCE Split Voice/Data interfaces as depicted in Figure 3-7 for the three legacy operational configurations with the R-RCE.

d. The AVN **must** support the separate F1/F2 operation when operating in the Split Voice/Data configuration in which Telco 1 is used for F1 audio, Telco 2 is used for F2 audio, and an RS-232 port is used for data.

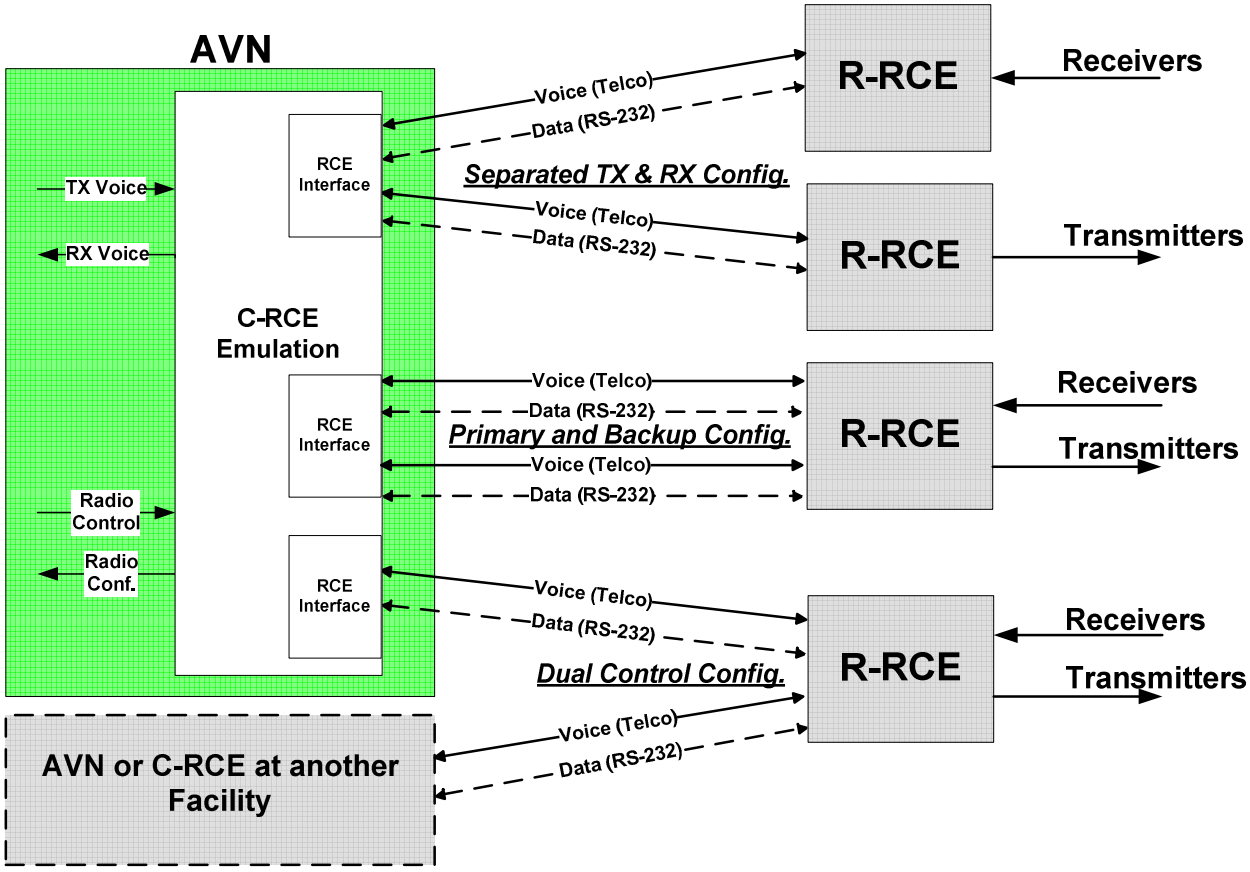

FIGURE 3-7 AVN / R-RCE Split Voice/Data Interface Configurations

3.2.2.4 Radio Control Interface

a. The AVN **must** encode radio control signals and transmit them to the R-RCE.

b. The AVN **must** decode all confirmation signals from the R-RCE for utilization within the AVN.

3.2.2.4.1 Push-to-Talk (PTT)

a. The AVN **must** encode up to two independent PTT signals for the two frequencies associated with a RCE channel and then transmit them to the R-RCE.

b. The AVN **must** decode up to two independent PTT confirmation signals received from the R-RCE for the two frequencies associated with a RCE channel and utilize them within the AVN.

3.2.2.4.2 PTT Release

a. The AVN **must** encode up to two independent PTT Release signals for the two frequencies associated with a RCE channel and then transmit them to the R-RCE.

b. The AVN **must** decode up to two independent PTT Release confirmation signals from the R-RCE for the two frequencies associated with a RCE channel and distribute them within the AVN.

3.2.2.4.3 Main/Standby Transmitter Select

a. The AVN **must** encode up to two independent M/S transmitter select signals for the two frequencies associated with a RCE channel and then transmit them to the R-RCE.

b. The AVN **must** decode up to two independent M/S transmitter confirmation signals from the R-RCE for the two frequencies associated with a RCE channel and distribute them within the AVN.

3.2.2.4.4 Main/Standby Receiver Select

a. The AVN **must** encode up to two independent M/S receiver select signals for the two frequencies associated with a RCE channel and then transmit them to the R-RCE.

b. The AVN **must** decode up to two independent M/S receiver confirmation signals from the R-RCE for the two frequencies associated with a RCE channel and distribute them within the AVN.

3.2.2.4.5 Remote Receiver Mute

a. The AVN **must** encode up to two independent receiver mute signals for the two frequencies associated with a RCE channel and then transmit them to the R-RCE.

b. The AVN **must** decode up to two independent receiver mute confirmation signals from the R-RCE for the two frequencies associated with a RCE channel and distribute them within the AVN.

3.2.2.4.6 Remote Receiver UnMute

a. The AVN **must** encode up to two independent receiver unmute signals for the two frequencies associated with a RCE channel and then transmit them to the R-RCE.

b. The AVN **must** decode up to two independent receiver unmute confirmation signals from the R-RCE for the two frequencies associated with a RCE channel and distribute them within the AVN.

3.2.2.4.7 Squelch Break

a. The AVN **must** decode up to two independent squelch break (SQB) confirmation signals from the R-RCE for the two frequencies associated with a RCE channel and distribute them within the AVN.

3.2.2.4.8 Frequency Lockout

a. The AVN **must** decode up to two independent frequency lockout signals from the R-RCE for the two frequencies associated with a RCE channel and distribute them within the AVN.

3.2.2.4.8 Automatic Gain Control (AGC)

a. The AVN **must** decode up to two independent automatic gain control (AGC) signals from the R-RCE for the two frequencies associated with a RCE channel and distribute them within the AVN.

3.2.2.5 Encoding and Decoding of Radio Control and Voice Signals

Source Code will be provided by the FAA to support design of communications link between the AVN and the existing R-RCE.

a. The AVN **must** utilize the software implemented modem algorithm provided by the FAA to encode and decode data messages to and from the R-RCE.

b. The AVN **must** encode and decode data messages to the R-RCE link by modulating and demodulating a 2880 Hz carrier.

c. The AVN **must** verify all control messages to the R-RCE with transmitted error check sequence bits to ensure command integrity.

d. The AVN **must** combine voice and data for simultaneous transmission to the R-RCE over the leased telephone line.

e. The AVN **must** transmit and receive data signals to and from the R-RCE using modem (modulator/demodulator) operating in the 2500 to 3000 Hz frequency band.

f. The AVN **must** low pass filter voice signals and transmit them to the R-RCE in the 300 to 2500 Hz frequency band.

3.2.3 NVS Remote Radio Node (RRN) to Control RCE (C-RCE) Interface

This section summarizes the characteristics of the RRN (R-RCE Emulation) to the C-RCE interface. Figure 3-8 shows the overall functional block diagram of the radio communications subsystems and identifies the RRN to C-RCE interface. Figure 3-9 summarizes the functional interface between the NVS and the C-RCE.

The NVS / R-RCE signal functions for the four-wire interface are provided in Table 3-14.

The RRN will emulate the R-RCE function and communicate with the existing C-RCE over a four-wire Telco line.

a. The RRN **must** interface with the C-RCE over a single four-wire voice grade (VG-6) transmission path.

b. The RRN **must** provide a physical interface to the C-RCE in accordance with the NVS to FTI IRD.

c. The RRN **must** provide an interface (channel) to the C-RCE for two radio frequencies to utilize one four-wire transmission path.

d. The RRN **must** provide an interface (channel) to the C-RCE that supports the capability to transmit and receive voice and radio control signals for up to two related A/G frequencies over a single four-wire voice grade transmission path.

e. The RRN **must** support monitoring, maintenance and configuration capabilities of the C-RCE over the same single four-wire voice grade (VG-6) interface used for voice and radio control signals.

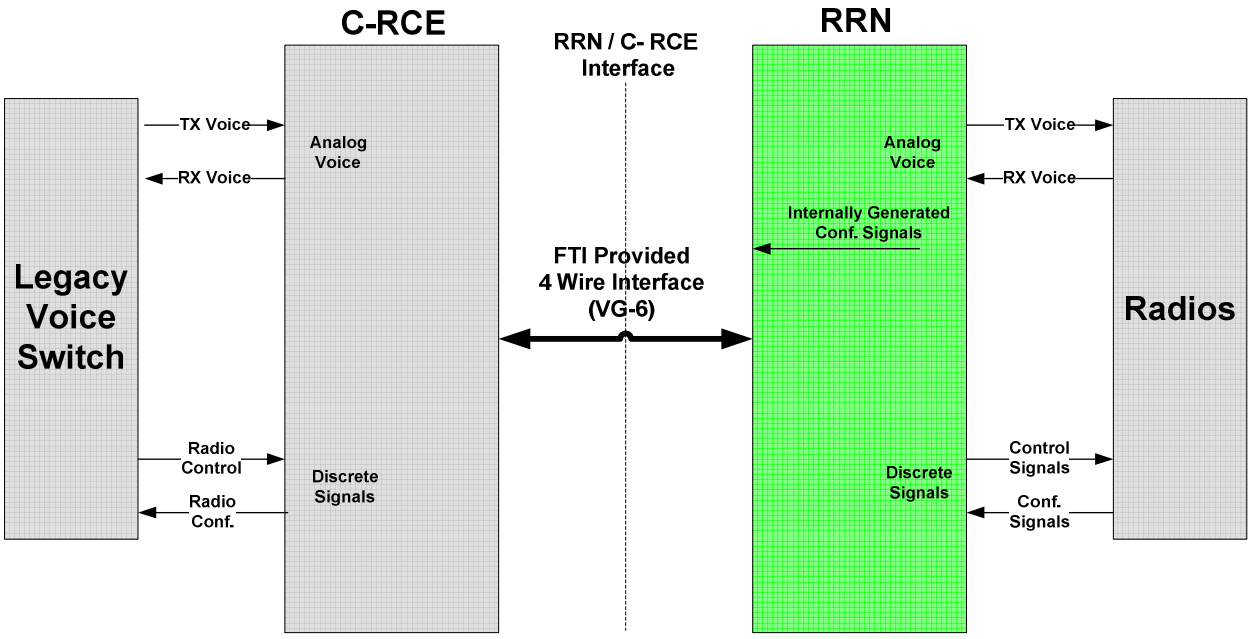

FIGURE 3-8 RRN / C-RCE Operational Functions

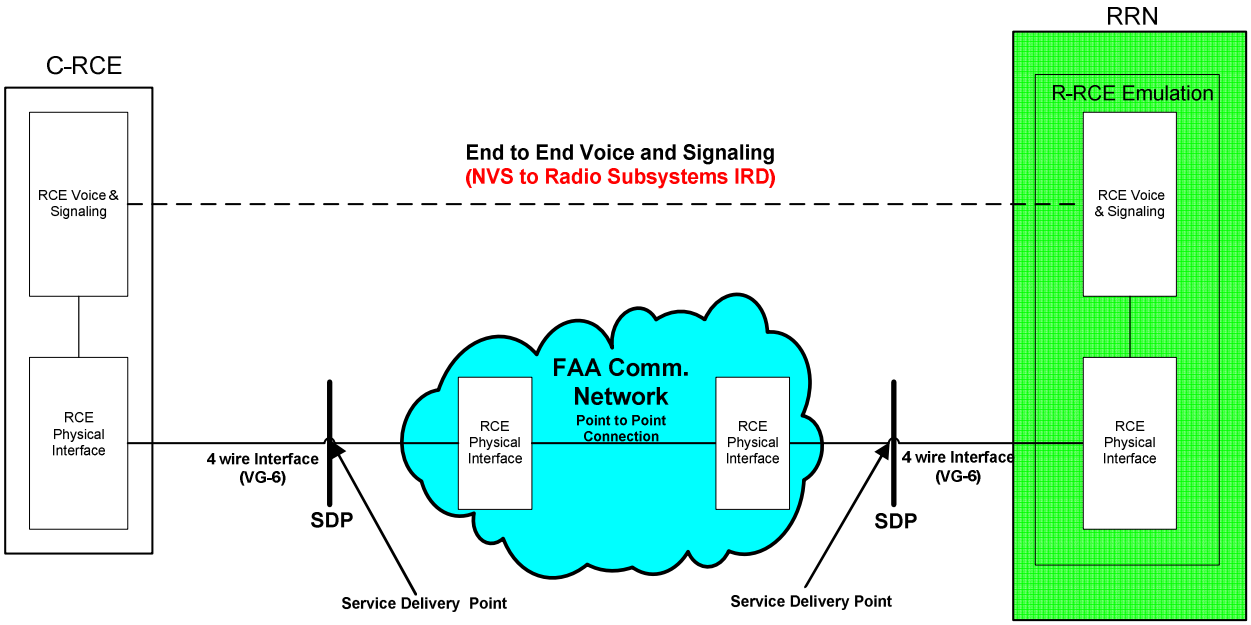

FIGURE 3-9 RRN / C-RCE Functional Interface

TABLE 3-14 Signal Functions for the RRN / C-RCE Interface

FUNCTION	SOURCE	DESTINATION	DESCRIPTION
TX Voice	C-RCE	RRN	Voice to the transmitters
RX Voice	RRN	C-RCE	Voice from the receivers
PTT/PTT Release Freq. 1	C-RCE	RRN	Keys/unkeys the freq. 1 transmitter
PTT/PTT Release Freq. 2	C-RCE	RRN	Keys/unkeys the freq. 2 transmitter
PTT Confirm/PTT Release Confirm Freq. 1	RRN	C-RCE	Confirms that freq. 1 PTT/PTT release signal was received from NVS
PTT Confirm/PTT Release Confirm Freq. 2	RRN	C-RCE	Confirms that freq. 2 PTT/PTT release signal was received from NVS
RX Mute/Unmute Freq. 1	C-RCE	RRN	Mutes/unmutes the freq. 1 receiver (RX)
RX Mute/Unmute Freq. 2	C-RCE	RRN	Mutes/unmutes the freq. 2 receiver (RX)
Mute/Unmute	RRN	C-RCE	Confirms freq. 1 receiver

FUNCTION	SOURCE	DESTINATION	DESCRIPTION
Confirm Freq. 1			muted/unmuted
Mute/Unmute Confirm Freq. 2	RRN	C-RCE	Confirms freq. 2 receiver muted/unmuted
M/S TX Select Freq. 1	C-RCE	RRN	Selects main/standby (M/S) freq. 1 transmitter (TX)
M/S TX Select Freq. 2	C-RCE	RRN	Selects main/standby (M/S) freq. 2 transmitter (TX)
M/S TX Select Confirm Freq. 1	RRN	C-RCE	Verifies selection of main/standby (M/S) freq. 1 transmitter (TX)
M/S TX Select Confirm Freq. 2	RRN	C-RCE	Verifies selection of main/standby (M/S) freq. 2 transmitter (TX)
M/S RX Select Freq. 1	C-RCE	RRN	Selects main/standby (M/S) freq. 1 receiver (RX)
M/S RX Select Freq. 2	C-RCE	RRN	Selects main/standby (M/S) freq. 2 receiver (RX)
M/S RX Select Confirm Freq. 1	RRN	C-RCE	Verifies selection of main/standby (M/S) freq. 1 receiver (RX)
M/S RX Select Confirm Freq. 2	RRN	C-RCE	Verifies selection of main/standby (M/S) freq. 2 receiver (RX)
Squelch Break Freq. 1	RRN	C-RCE	Indicates audio present on receiver (RX) freq. 1
Squelch Break Freq. 2	RRN	C-RCE	Indicates audio present on Receiver (RX) freq. 2
Frequency Lockout Freq. 1	RRN	C-RCE	In a dual control site, it indicates that the other site's controller is transmitting on that frequency.
Frequency Lockout Freq. 2	RRN	C-RCE	In a dual control site, it indicates that the other site's controller is transmitting on that frequency.
AGC Freq. 1	RRN	C-RCE	Indicates Signal Strength from receiver for freq. 1
AGC Freq. 2	RRN	C-RCE	Indicates Signal Strength from receiver for freq. 2

3.2.3.1 RRN / C-RCE Trunk Interfaces

The RRN will provide four, four-wire trunk interfaces to support different control modes of the C-RCE. Each trunk from the C-RCE interface consists of a two-wire pair for TX and a two-wire pair for RX. Figure 3-10 depicts how the RRN four-wire interfaces to the C-RCE support the Separated TX and RX Configuration, Primary and Backup Configuration and Dual Control Configuration.

a. The RRN **must** provide the four-wire interfaces as depicted in Figure 3-10 for the three legacy operational configurations with the C-RCE.

b. The RRN **must** be configurable to support, at a minimum, two active and two standby four-wire interfaces per RCE channel.

c. The RRN **must** provide four-wire interfaces to the C-RCE channel that are transformer coupled with an impedance of 600 ohms ± 10%.

d. The RRN **must** provide two-wire TX audio interfaces with adjustable gain to receive audio from the C-RCE over the range of -40 dBm to +7 dBm (test tone level).

e. The RRN **must** provide two-wire RX audio interfaces to the C-RCE that are adjustable over the range of -40 dBm to +7 dBm (test tone level).

f. The RRN **must** provide independent level control of the data modem and voice signals over the C-RCE four-wire interface.

g. The RRN **must** provide four-wire interfaces to the C-RCE channel that have a frequency response of 300 to 3,000 Hz +/- 1 dB.

h. The RRN **must** provide four-wire interfaces to the C-RCE channel that have a surge protection of 400 Volts and 100A.

3.2.3.2 RRN RS-232 Pass-Through Interface

The RRN will provide pass-through RS-232 interfaces with the C-RCE for remote monitoring and control as was shown in Figure 3-1. Figure 3-10 depicts how each of the operational configurations provides an RS-232 port function for data.

a. The RRN **must** provide R-RCE emulation that supports pass-through asynchronous interfaces with the C-RCE in accordance with TIA-232.

b. The RRN **must** provide pass-through RS-232 interfaces as depicted in the three operational configurations shown in Figure 3-10.

c. The RRN **must** provide three (3) RS-232 ports.

d. The RRN **must** provide baud rate range of 150 to 9600 baud.

e. The RRN **should** provide baud rate of 19,200 baud or more.

f. The RRN **must** be selectable to even, odd, or none parity.

g. The RRN **must** be selectable for 7 or 8 bit blocks.

h. The RRN **must** be selectable for 1 or 2 stop bits.

i. The RRN **must** be selectable hardware or none for handshaking.

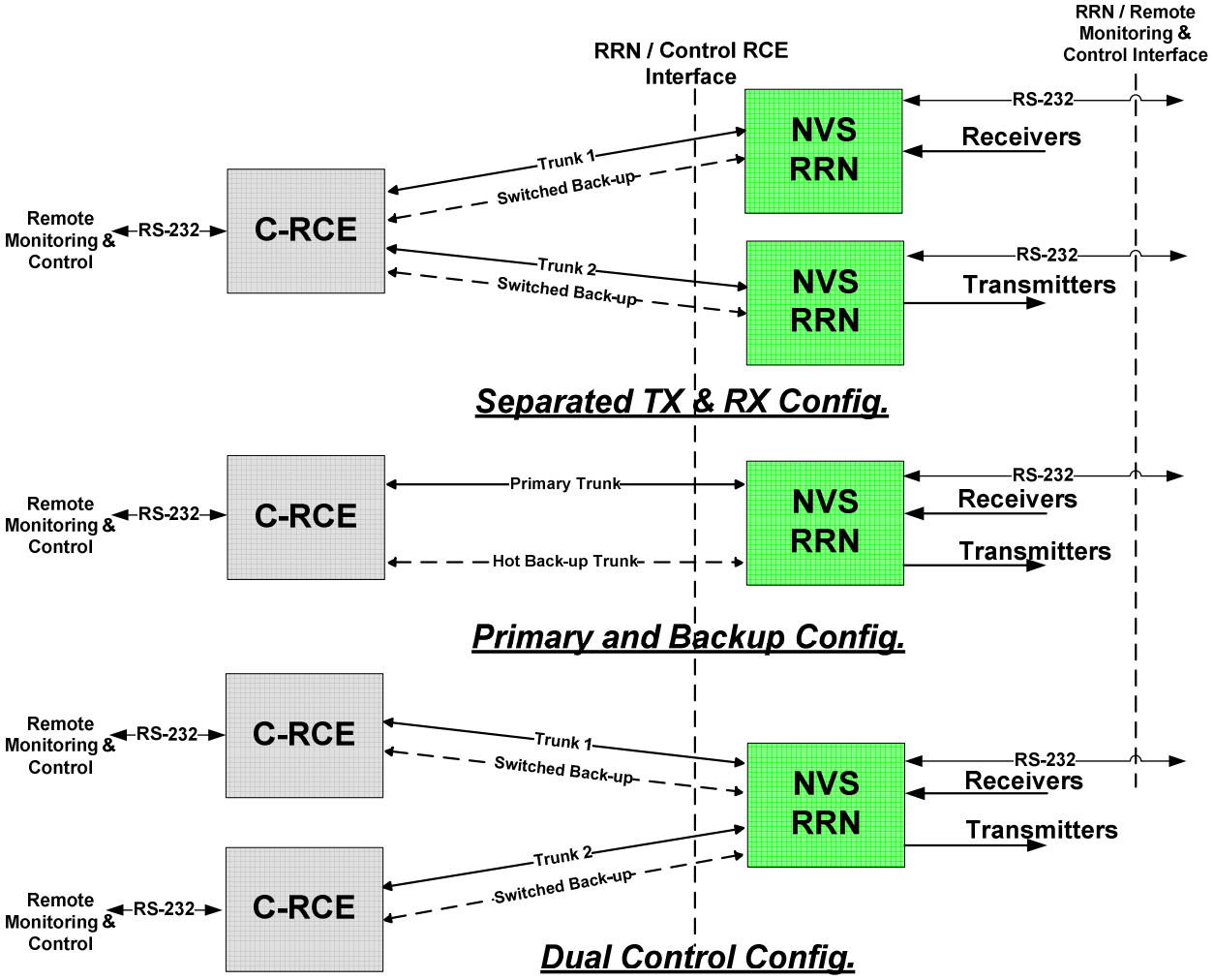

FIGURE 3-10 RRN / C-RCE Interface Configurations

3.2.3.3 RRN / C-RCE Split Voice and Data Configuration

The RRN will provide RCE interfaces that support a Split Voice/Data option for the three legacy operational configurations covered in section 3.2.3.1. Figure 3-11 depicts how each of the operational configurations utilizes the Telco port for voice and an RS-232 port for data. Note that backup trunks to the C-RCE will only be available in the "Primary and Backup Configuration".

a. The RRN **must** support the RCE Split Voice/Data interfaces in which the Telco port will contain only voice and data is routed out of an RS-232 port.

b. The RRN **must** provide pass-through asynchronous interfaces for the data port with the C-RCE in accordance with TIA-232.

c. The RRN **must** provide the RCE Split Voice/Data interfaces as depicted in Figure 3-11 for the three legacy operational configurations with the C-RCE.

d. The RRN **must** support the separate F1/F2 operation when operating in the Split Voice/Data configuration in which Telco 1 is used for F1 audio, Telco 2 is used for F2 audio, and an RS-232 port is used for data.

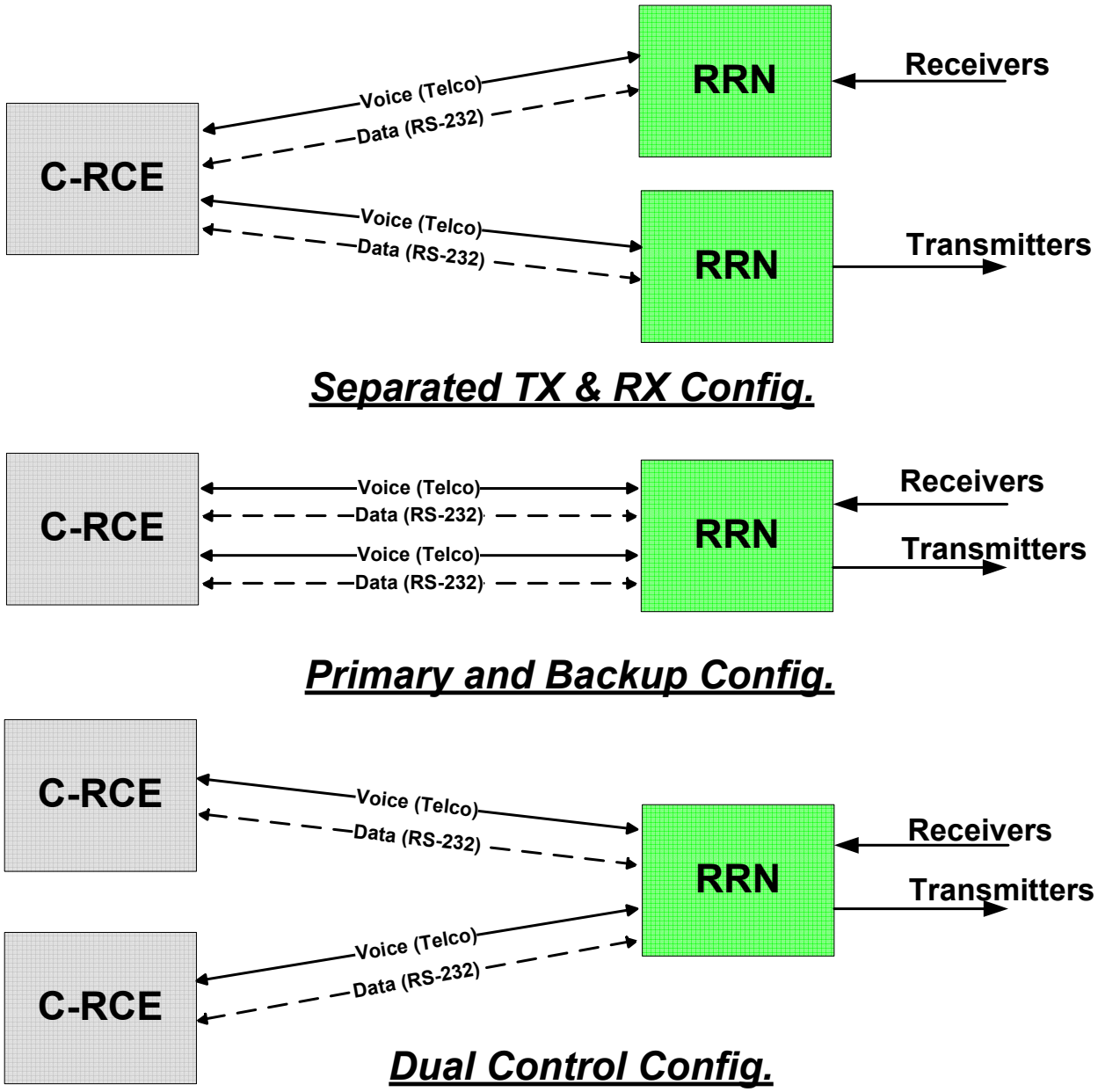

FIGURE 3-11 RRN / C-RCE Split Voice/Data Interface Configurations

3.2.3.4 Radio Control Interface

a. The RRN **must** decode radio control signals from the C-RCE and provide them to the A/G radios.

b. The RRN **must** encode both internally and externally generated confirmation signals and transmit them to the C-RCE.

3.2.3.4.1 Push-to-Talk (PTT)

a. The RRN **must** decode up to two independent PTT signals received from the C-RCE for the two frequencies associated with a RCE channel and provide a keying signal to the corresponding transmitter via the RRN / Radio interface.

b. The RRN **must** encode up to two independent PTT confirmation signals for the two frequencies associated with a RCE channel and transmit them to the C-RCE.

3.2.3.4.2 PTT Release

a. The RRN **must** decode up to two independent PTT released signals received from the C-RCE for the two frequencies associated with a RCE channel and provide an unkeying signal to the corresponding transmitter via the RRN/Radio interface.

b. The RRN **must** encode up to two independent PTT Release confirmation signals for the two frequencies associated with a RCE channel and transmit them to the C-RCE.

3.2.3.4.3 Main/Standby Transmitter Select

a. The RRN **must** decode up to two independent M/S transmitter select signals received from the C-RCE for the two frequencies associated with a RCE channel and select the main or standby transmitter via the RRN/Radio interface.

b. The RRN **must** encode up to two independent M/S transmitter confirmation signals for the two frequencies associated with a RCE channel and transmit them to the C-RCE.

3.2.3.4.4 Main/Standby Receiver Select

a. The RRN **must** decode up to two independent M/S receiver select signals received from the C-RCE for the two frequencies associated with a RCE channel and select the main or standby receiver via the RRN/Radio interface.

b. The RRN **must** encode up to two independent M/S receiver confirmation signals for the two frequencies associated with a RCE channel and transmit them to the C-RCE.

3.2.3.4.5 Remote Receiver Mute

a. The RRN **must** decode up to two independent receiver mute signals received from the C-RCE for the two frequencies associated with a RCE channel and provide a mute signal to the selected receiver.

b. The RRN **must** encode up to two independent receiver mute confirmation signals for the two frequencies associated with a RCE channel and transmit them to the C-RCE.

3.2.3.4.6 Remote Receiver UnMute

a. The RRN **must** decode up to two independent receiver unmute signals received from the C-RCE for the two frequencies associated with a RCE channel and provide an unmute signal to the selected receiver.

b. The RRN **must** encode up to two independent receiver unmute confirmation signals for the two frequencies associated with a RCE channel and transmit them to the C-RCE.

3.2.3.4.7 Squelch Break

a. The RRN **must** encode up to two independent squelch break signals for the two frequencies associated with a RCE channel and transmit them to the C-RCE.

3.2.3.4.8 Automatic Gain Control (AGC)

a. The RRN **must** encode up to two independent AGC signals for the two frequencies associated with a RCE channel and transmit them to the C-RCE.

3.2.3.5 Encoding and Decoding of Radio Control and Voice Signals

Source Code will be provided by the FAA to support design of communications link between the RRN and the existing C-RCE.

a. The RRN **must** utilize the software implemented modem algorithm provided by the FAA to encode and decode data messages to and from the C-RCE.

b. The RRN **must** encode and decode data messages on to the link by modulating and demodulating a 2880 Hz carrier.

c. The RRN **must** verify all control messages to the C-RCE with transmitted error check sequence bits to insure command integrity.

d. The RRN **must** combine voice and data for simultaneous transmission to the C-RCE over the leased telephone line.

e. The RRN **must** transmit and receive data signals using modem (modulator / demodulator) operating in the 2500 to 3000 Hz frequency band.

f. The RRN **must** low pass filter voice signals and transmit them to the C-RCE in the 300 to 2500 Hz frequency band.

3.2.4 NVS Remote Radio Node (RRN) to Legacy Radios Interface

This section summarizes the characteristics of the RRN to the Legacy Radio interface. Some variation by site can be expected, and so complete details will be specified by the government at

time of order. Figure 3-12 shows an overall operational block diagram of the radio communications subsystems and identifies the RRN to Radio interface.

Figure 3-13 summarizes the functional interface between the RRN and the Legacy Radios. Depending on the FAA radios being utilized, a subset of the signaling shown in Figure 3-13 may be required.

The RRN / Legacy Radio discrete and analog signal functions for a single frequency are provided in Table 3-15.

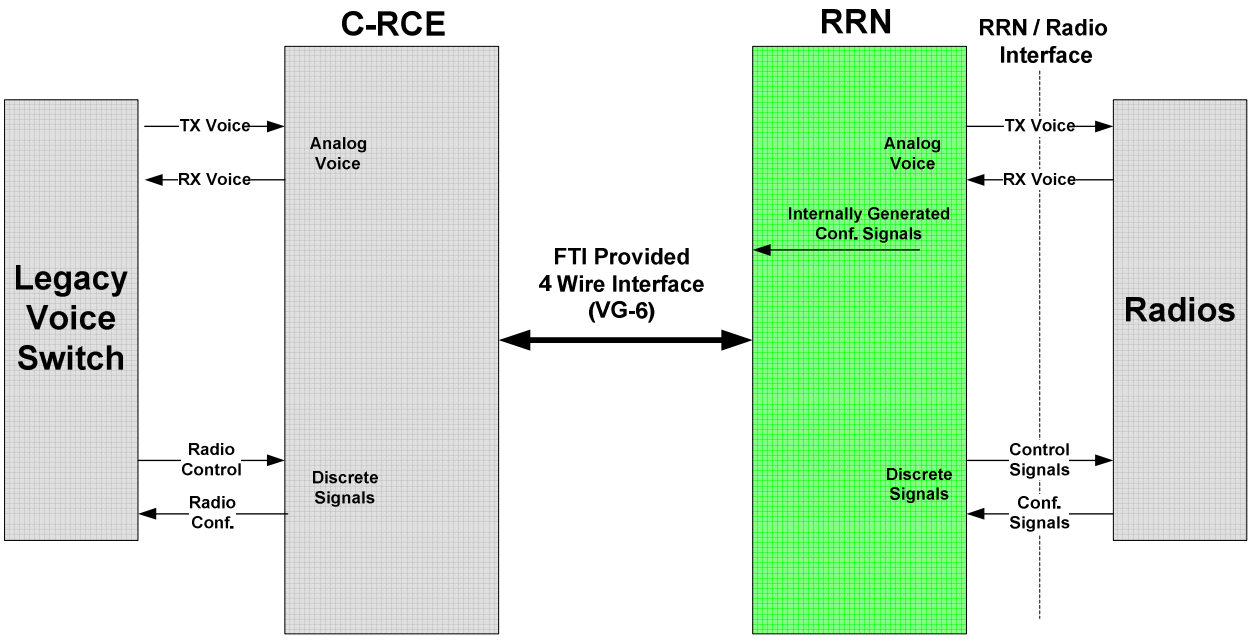

FIGURE 3-12 RRN / Radio Operational Functions

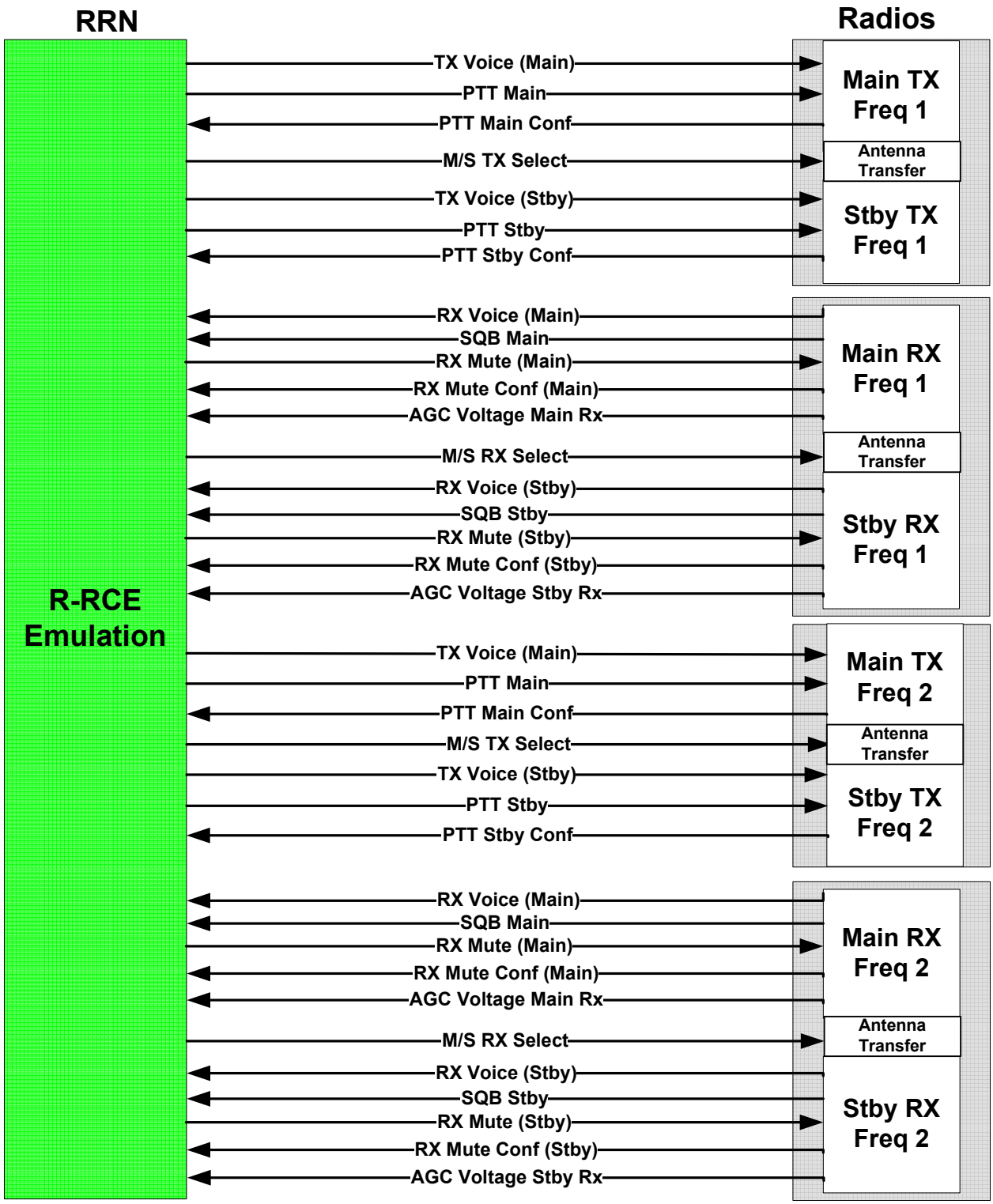

FIGURE 3-13 RRN / Legacy Radio Functional Interface

TABLE 3-15 Discrete and Analog Signal Functions for RRN / Radio Interface (Single Frequency)

FUNCTION	SOURCE	DESTINATION	DESCRIPTION
TX Voice (Main)	RRN	Radio	Voice to the main transmitter
RX Voice (Main)	Radio	RRN	Voice from the main receiver
TX Voice (Stby)	RRN	Radio	Voice to the standby transmitter
RX Voice (Stby)	Radio	RRN	Voice from the standby receiver
PTT/PTT Release Main TX	RRN	Radio	Keys/unkeys the main transmitter
PTT/PTT Release Stby TX	RRN	Radio	Keys/unkeys the standby transmitter
PTT /PTT Release Confirm Main TX	Radio	RRN	Confirms that Main TX PTT/PTT release signal was received from RRN
PTT /PTT Release Confirm Stby TX	Radio	RRN	Confirms that Stby TX PTT/PTT release signal was received from RRN
Mute/Unmute Main RX	RRN	Radio	Mutes/unmutes the main receiver
Mute/Unmute Stby RX	RRN	Radio	Mutes/unmutes the standby receiver
Mute/Unmute Conf Main RX	Radio	RRN	Confirms main receiver muted/unmuted
Mute/Unmute Conf Stby RX	Radio	RRN	Confirms standby receiver muted/unmuted
M/S TX Select	RRN	Antenna Transfer Relay	Selects main/standby transmitter
M/S RX Select	RRN	Antenna Transfer Relay	Selects main/standby receiver
SQB Main RX	Radio	RRN	Indicates audio present on main receiver
SQB Stby RX	Radio	RRN	Indicates audio present on standby receiver
AGC Voltage Main RX	Radio	RRN	Signal strength indication for main receiver

FUNCTION	SOURCE	DESTINATION	DESCRIPTION
AGC Voltage Stby RX	Radio	RRN	Signal strength indication for standby receiver

3.2.4.1 Legacy Radio Audio

a. The RRN **must** provide a two-wire interface that provides a TX audio signal to each transmitter comprising the radio frequency interface (i.e., main transmitter and standby transmitter).

b. The RRN **must** provide a two-wire TX audio interface that is transformer coupled with an impedance of 600 ohms ± 10% to each transmitter.

c. The RRN **must** provide a two-wire TX audio interface at a level of -8dBm that is adjustable ± 8 dB (test tone level) to each transmitter.

d. The RRN **must** provide a two-wire TX audio interface that has a frequency response of 300 to 3,000 Hz +/- 1 dB to each transmitter.

e. The RRN **must** provide a two-wire interface that accepts an RX audio signal from each receiver comprising the radio frequency interface (i.e., main receiver and standby receiver).

f. The RRN **must** provide a two-wire RX audio interface that is transformer coupled with an impedance of 600 ohms ± 10% to each receiver.

g. The RRN **must** provide a two-wire interface that accepts an RX audio signal from each receiver at a level of -8dBm, adjustable ± 8 dB (test tone level).

h. The RRN **must** provide a two-wire RX audio interface that has a frequency response of 300 to 3,000 Hz +/- 1 dB to each receiver.

i. The RRN **must** provide two-wire pairs that are transformer coupled, balanced, and isolated from ground for both the TX and RX interfaces to the radio.

3.2.4.2 Radio Control Signaling

a. The RRN **must** provide control signaling for a minimum of two frequencies per radio interface.

b. The RRN **must** accept confirmation signaling for a minimum of two frequencies per radio interface.

c. The RRN **must** provide +24 VDC, as directed at time of order, to the Antenna Transfer Relay (ATR) for transmitter and receiver main/standby selection as specified in section 3.3.1.3.

3.2.4.2.1 Push-to-Talk (PTT)/PTT Release

Keying is typically accomplished by applying a ground to the key input of the transmitters. A ground is continuously applied until a PTT release condition is received from the C-RCE.

Receipt of the PTT release condition results in disconnection of the ground at the transmitter interface.

Site adaptable keying may also be accomplished by providing relay contact closure to the keying line of the input to the transmitters, which is covered in this section.

a. The RRN **must** provide a relay contact closure (ground return) to the PTT inputs of main and standby transmitters to activate PTT.

b. The RRN **must** provide an open relay contact to the PTT inputs of main and standby transmitters to deactivate the PTT feature.

c. The RRN **must** meet the parameters for the PTT interface of main and standby transmitters as specified in Table 3-16.

TABLE 3-16 RRN Parameters for PTT

Function	Relay State	Contact Voltage	Contact Current	Contact Resistance
PTT	Contacts closed (ground)	N/A	60 mA max.	10 ohms max.
PTT Release	Contacts open	60 VDC max. (any polarity)	100 uA max. leakage current	10 Mega ohm min.

3.2.4.2.2 Receiver Mute/Unmute

a. The RRN **must** provide a relay contact closure (ground return) to the Mute/Unmute inputs of main and standby receivers to mute the receiver.

b. The RRN **must** provide an open relay contact to the Mute/Unmute inputs of main and standby receivers to deactivate the receiver mute feature.

c. The RRN **must** meet the parameters for the Mute/Unmute interface of main and standby receivers as specified in Table 3-17.

TABLE 3-17 RRN Parameters for Receiver Mute

Function	Relay State	Contact Voltage	Contact Current	Contact Resistance
Receiver Mute	Contacts closed	N/A	60 mA max.	10 ohms max.
Receiver Unmute	Contacts open	60 VDC max.	100 uA max. leakage current	10 Mega ohm min.

3.2.4.2.3 Main/Standby (M/S) Transmitter Select

The main/standby radio select controls (1) configure the RRN to communicate on either the main or standby transmitter interface, and (2) are used in some installations to control an external antenna transfer relay (ATR) switch.

The ATR connects either the main or the standby transmitter to the site antenna. The RRN provides + 24 VDC to one side of the ATR coil and an open or ground to the other side of the relay coil to control main/standby transmitter selection, which is covered in this section.

a. The RRN **must** provide a ground to the ATR input for the selection of standby transmitter.

b. The RRN **must** provide an open circuit to the ATR input for the selection of main transmitter.

c. The RRN **must** meet the parameters for the selection of M/S transmitters as specified in Table 3-18.

TABLE 3-18 RRN Parameters for M/S Selection of Transmitters

Function	Level	Current	Resistance
Stby TX	Ground	100 mA max.	100 ohms max. to ground
Main TX	Open Circuit	100 uA max. leakage current	10 Mega ohm min.

3.2.4.2.4 Main/Standby (M/S) Receiver Select

The main/standby radio select controls (1) configure the RRN to communicate on either the main or standby receiver interface, and (2) are used in some installations to control an external antenna transfer relay (ATR) switch.

The ATR connects either the main or the standby receiver to the site antenna. The RRN provides + 24 VDC to one side of the ATR coil and an open or ground to the other side of the relay coil to control main/standby receiver selection, which is covered in this section.

a. The RRN **must** provide a ground to the ATR input for the selection of standby receiver.

b. The RRN **must** provide an open circuit to the ATR input for the selection of main receiver.

c. The RRN **must** meet the parameters for the selection of M/S receivers as specified in Table 3-19.

TABLE 3-19 RRN Parameters for M/S Selection of Receivers

Function	Level	Current	Resistance
Stby RX	0.0 VDC ± 1VDC	100 mA max.	100 ohms max. to ground
Main RX	Open Circuit	100 uA max. leakage current	10 Mega ohm min.

3.2.4.2.5 Push-to-talk (PTT)/PTT Release Confirmation

a. The RRN **must** accept a contact closure from the main and standby transmitter PTT confirmation outputs of to indicate an active PTT status.

b. The RRN **must** accept an open contact from the main and standby transmitter PTT confirmation outputs to indicate an inactive PTT status.

c. The RRN **must** meet the parameters for the main and standby transmitter PTT confirmation interface as specified in Table 3-20.

TABLE 3-20 RRN Parameters for Transmitter PTT Confirmation

Function	State	RRN Supplied Voltage	RRN Supplied Current	Contact Resistance
PTT Confirmation	Contacts closed	N/A	60 mA max.	10 ohms max.
PTT Release Confirmation	Contacts open	60 VDC max.	N/A	1 Mega ohm min.

3.2.4.2.6 Receiver Mute Confirmation

b. The RRN **must** accept a contact closure from the main and standby receiver Mute confirmation outputs to indicate receiver is muted.

b. The RRN **must** accept an open contact from the main and standby receiver Mute confirmation outputs to indicate receiver is not muted.

c. The RRN **must** meet the parameters for the main and standby receiver Mute confirmation interface as specified in Table 3-21.

TABLE 3-21 RRN Parameters for Receiver Mute Confirmation

Function	State	RRN Supplied Voltage	RRN Supplied Current	Contact Resistance
Receiver Muted	Contacts closed	N/A	60 mA max.	10 ohms max.
Receiver Not muted	Contacts open	60 VDC max.	N/A	1 Mega ohm min.

3.2.4.2.7 Receiver Squelch Break (SQB)

The RRN will support two different configurations to provide receiver squelch status to the C-RCE. One method uses the Voice Activated Circuit (VOX) threshold at the R-RCE to detect receiver audio and provide the squelch break indication based on this threshold. The other method requires a squelch break signal from the receiver, which is covered in this section.

a. The RRN **must** accept a contact closure from the main and standby receiver Squelch Break confirmation outputs to indicate that received audio is present.

b. The RRN **must** accept an open contact from the main and standby receiver Squelch Break confirmation outputs to indicate that received audio is not present.

c. The RRN **must** meet the parameters for the receiver Squelch Break confirmation interface as specified in Table 3-22.

TABLE 3-22 RRN Parameters for Receiver Squelch break

Function	State	RRN Supplied Voltage	RRN Supplied Current	Contact Resistance
Audio Present	Contacts closed	N/A	60 mA	10 ohms max.
Audio Not Present	Contacts open	60 VDC	N/A	1 Mega ohm min.

3.2.4.2.8 Automatic Gain Control (AGC) Voltage from the A/G Radio Interface

a. The RRN **must** accept a voltage from the main and standby receiver AGC outputs to indicate that audio level.

b. The RRN **must** meet the input parameters for the receiver AGC signal outputs as specified in Table 3-23.

TABLE 3-23 RRN Input Parameters for Receiver AGC Voltage

Function	Nominal Voltage	Nominal Current
AGC Signal Levels	0 to 10 VDC	0.5 mA max (sink)

3.2.5 AVN to Networked Radios Interface

As was shown in Figure 3-1, the AVN will provide network interfaces to Internet Protocol (IP) capable radios. Requirements outlining the characteristics for the AVN interface with IP radios are covered in this section.

a. The AVN **must** provide IP radio interfaces that support Internet Protocol version 4 (IPv4) in accordance with RFC-791.

b. The AVN **should** provide IP radio interfaces that support Internet Protocol version 6 (IPv6) in accordance with RFC 2460.

c. The AVN **must** provide IP radio interfaces that support an Ethernet Data Link layer in accordance with IEEE 802.3.

d. The AVN **must** provide IP radio interfaces that support a full-duplex Ethernet (10 Mbps) Physical layer in accordance with IEEE 802.3.

e. The AVN **must** provide IP radio interfaces that support a full-duplex Fast Ethernet (100 Mbps) Physical layer in accordance with IEEE 802.3.

f. The AVN **must** provide IP radio interfaces that support a full-duplex Gigabit Ethernet (1,000 Mbps) Physical layer in accordance with IEEE 802.3.

g. The AVN **must** provide IP Radio interfaces that support Voice over IP (VoIP) communications protocol in accordance with EUROCAE ED-137 specification, Part I.

h. The AVN **must** provide IP radio interfaces in accordance with the NVS to FTI IRD.

3.2.6 RRN to Networked Radios Interface

As was shown in Figure 3-1, the RRN will provide network interfaces to Internet Protocol (IP) capable radios. Requirements outlining the characteristics for the RRN interface with IP radios are covered in this section.

a. The RRN **must** provide IP radio interfaces that support Internet Protocol version 4 (IPv4) in accordance with RFC-791.

b. The RRN **should** provide IP radio interfaces that support Internet Protocol version 6 (IPv6) in accordance with RFC 2460.

c. The RRN **must** provide IP radio interfaces that support an Ethernet Data Link layer in accordance with IEEE 802.3.

d. The RRN **must** provide IP radio interfaces that support a full-duplex Ethernet (10 Mbps) Physical layer in accordance with IEEE 802.3.

e. The RRN **must** provide IP radio interfaces that support a full-duplex Fast Ethernet (100 Mbps) Physical layer in accordance with IEEE 802.3.

f. The RRN **must** provide IP radio interfaces that support a full-duplex Gigabit Ethernet (1,000 Mbps) Physical layer in accordance with IEEE 802.3.

g. The RRN **must** provide IP radio interfaces that support Voice over IP (VoIP) communications protocol in accordance with EUROCAE ED-137 specification, Part I.

h. The RRN **must** provide IP radio interfaces in accordance with the NVS to FTI IRD.

i. The RRN **must** provide a minimum of 8 radio Session Internet Protocol (SIP) sessions at the radio interfaces (one per each 8 radios connected to the RRN (i.e., MTXF1, MRXF1, STXF1, SRXF1, MTXF2, MRXF2, STXF2, SRXF2).

3.2.7 AVN Versatile Alarm Monitoring (VAM) Interface

This section describes the physical contact requirements of the legacy C-RCE VAM that has been used to monitor and control events and actions. VAM functionality is further described in the NVS specification, but below are a list of contact requirements to achieve VAM functionalities:

a. The AVN **must** provide a minimum of 8 contact inputs.

b. The AVN **must** provide a minimum of 12 digital inputs, with an open circuit or voltage below 1.5 volts considered as logic low signal, and a signal above 1.5 volt trip level is considered as logic high.

c. The AVN **must** provide a minimum of 4 analog inputs with 0 to 10 volts range.

d. The AVN **should** provide a minimum of 16 analog inputs with 0 to 5 volts range.

e. The AVN **must** provide a minimum of 8 contact outputs.

f. The AVN **must** provide a minimum of 29 digital outputs as such: 8 outputs with 9 to 12 ground voltage; 16 outputs with open collector/ground; and 5 outputs with relay sink current driver ground/open collector.

g. The AVN **must** provide a minimum of 2 analog outputs with a range of 0 to 10 volts.

3.2.8 RRN Versatile Alarm Monitoring (VAM) Interface

This section describes the physical contact requirements of the legacy R-RCE VAM that has been used to monitor and control events and actions. VAM functionality is further described in the NVS specification, but below are a list of contact requirements to achieve VAM functionalities:

a. The RRN **must** provide a minimum of 8 contact inputs.

b. The RRN **must** provide a minimum of 12 digital inputs, with an open circuit or voltage below 1.5 volts considered as logic low signal, and a signal above 1.5 volt trip level is considered as logic high.

c. The RRN **must** provide a minimum of 4 analog inputs with 0 to 10 volts range.

d. The RRN **should** provide a minimum of 16 analog inputs with 0 to 5 volts range.

e. The RRN **must** provide a minimum of 8 contact outputs, with a minimum of 4 outputs configurable for normal open or normal closed operation.

f. The RRN **must** provide a minimum of 29 digital outputs as such: 8 outputs with 9V to 12V ground; 16 outputs with open collector/ground; and 5 outputs with relay sink current driver ground/open collector.

g. The RRN **must** provide a minimum of 2 analog outputs with a range of 0 to 10 volts.

3.2.9 RRN to Maintenance Interface

a. The RRN **must** provide a minimum of two (2) SIP sessions available to the maintenance interface.

3.3 Physical Requirements

3.3.1 Electrical Power/Electronic Requirements

This section provides the electrical power/electronic requirements for the NVS to Radio Subsystems interfaces. The requirements specified in this section are described in accordance with FAA-G-2100.

3.3.1.1 FAA Provided Power to the AVN for Control of Local Radios

a. The AVN **must** accept +48 VDC power ± 5%, ≥ 60 mA for each Local Radio interface, as directed at time of order to be used as the voltage source for radio control.

3.3.1.2 AVN Provided Power and Ground Signal to Local Radios

a. The AVN **must** provide +24 VDC power ± 5%, ≥ 60 mA for each Local Radio interface, as directed at time of order, to the Local Radio demarcation frame to be used as the voltage source for radio control options.

b. The AVN **must** provide +48 VDC power ± 5%, ≥ 60 mA for each Local Radio interface, as directed at time of order, to the Local Radio demarcation frame to be used as the voltage source for radio control options.

c. The AVN **must** provide a ground signal to each Local Radio Interface to be used for transmitter keying.

3.3.1.3 RRN Provided Power to Radios

a. The RRN **must** provide +24 VDC power ± 5%, ≥ 60 mA for each Antenna Transfer Relay (ATR) interface, as directed at time of order.

3.3.1.4 Connectors

The pin layouts for the connectors can be found in section 3.3.1.6.

a. The NVS **must** utilize a standard 50-pin "male" Amphenol-style cable connector (3M Inc. P/N 3564-1002 or equivalent) at the FAA Distribution Frame for Local Radio interfaces.

b. The NVS **must** utilize a standard 50-pin "male" Amphenol-style cable connector (3M Inc. P/N 3564-1002 or equivalent) at the FAA Distribution Frame for four-wire RCE interfaces.

c. RS-232 connector requirements TBD

d. IP connector requirements TBD

e. The NVS **must** comply with the removable parts and mating connector requirements in accordance with FAA-G-2100, paragraph 3.1.2.1, for all interconnections at the radio subsystems interfaces.

f. The NVS **must** comply with the electrical connector requirements in accordance with FAA-G-2100, paragraph 3.3.1.4.3, for all interconnections at the radio subsystems interfaces.

g. The NVS **must** comply with the electrical connector safety requirements in accordance with FAA-G-2100, paragraph 3.3.5.1.12, for all interconnections at the radio subsystems interfaces.

h. The NVS **must** comply with the mechanical interconnection requirements in accordance with FAA-G-2100, paragraph 3.3.5.4.1, for all interconnections at the radio subsystems interfaces.

i. The NVS **must** use general utility type, polarized standard connectors at all radio subsystems interfaces.

3.3.1.5 Wire/Cable

The cable lengths for the NVS to Radio Subsystems interfaces will be determined at site survey.

a. The NVS **must** comply with the wiring requirements at all radio subsystems interfaces in accordance with FAA-G-2100, paragraph 3.3.1.4.10.

b. The NVS **must** utilize a 24 American Wire Gauge (AWG) twisted pair cable construction with an overall braided shield at the legacy radio and radio control interfaces.

c. The NVS **must** utilize a 24 American Wire Gauge (AWG) twisted pair cable construction with an overall braided shield at the remote monitoring and control interfaces.

d. The NVS **must** utilize Category 5e UTP cable for Network Radio (IP) interfaces.

3.3.1.5.1 Markings

This section provides the marking and labeling requirements for the FAA Distribution Frame interface. Marking standards will adhere to FAA-G-2100 requirements and will be applicable to Commercial-Off-The-Shelf (COTS) equipment.

a. The NVS **must** comply with the requirements for reference designations and other markings for the all radio subsystems interfaces at the FAA Distribution Frames in accordance with FAA-G-2100, paragraphs 3.3.1.4.10.2 and 3.3.3.2.

3.3.1.6 Interface Wiring

This section describes the interface wiring requirements for the FAA Distribution Frame interfaces.

3.3.1.6.1 AVN to Local Radio Interface Wiring

a. The AVN **must** utilize connectorized cables for the Local Radio interface in accordance with the standard AT&T wiring pattern code.

3.3.1.6.1.1 Voltage Controlled Local Radio

a. The AVN **must** employ 19 wires of the connectorized cable (one local radio per cable) for the voltage controlled local radio interface, while the remaining 31 wires are utilized as spares as shown in Figure 3-14.

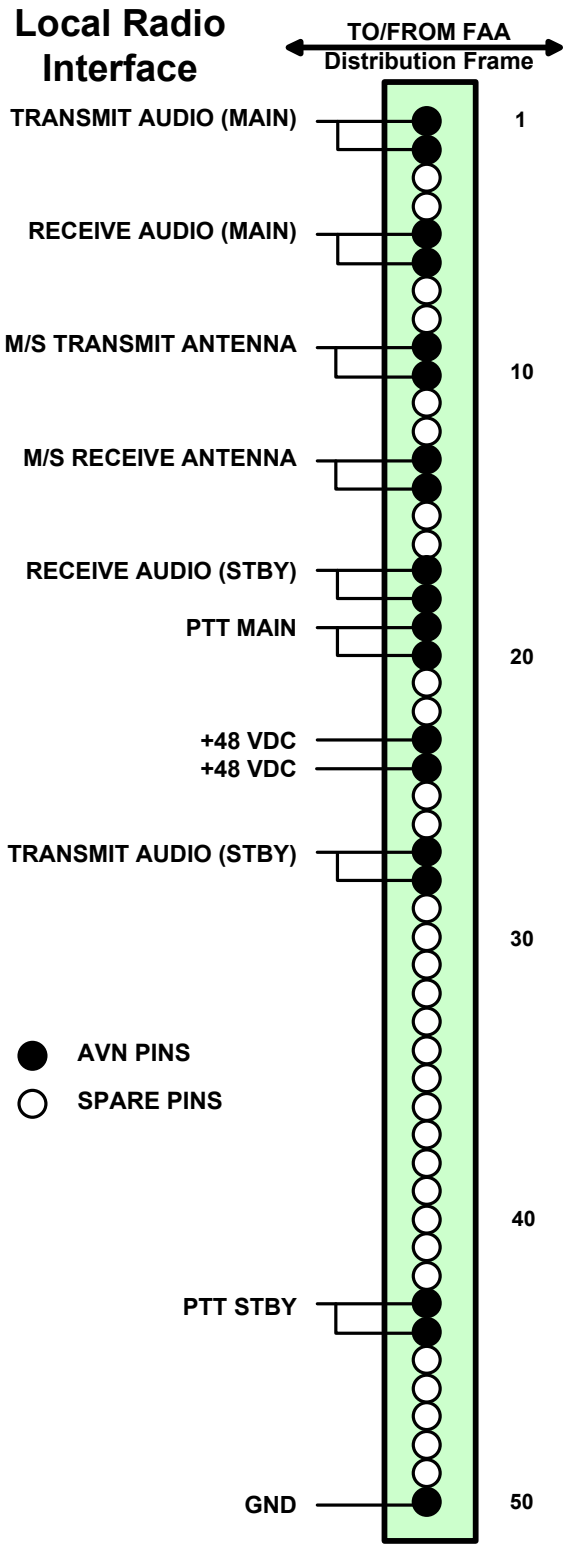

FIGURE 3-14 AVN to Voltage Controlled Local Radio Pin Assignments

3.3.1.6.1.2 Contact Closure Controlled Local Radio

To be determined at site survey

3.3.1.6.2 AVN to R-RCE Interface Wiring

a. The AVN **must** utilize connectorized cables for the C-RCE Emulation four-wire interface in accordance with the standard AT&T wiring pattern code.

b. The AVN **must** employ 48 wires of the connectorized cable (12 four-wire interfaces per cable) for the RCE Emulation interface cable, while the remaining two wires are utilized as spares as shown in Figure 3-15.

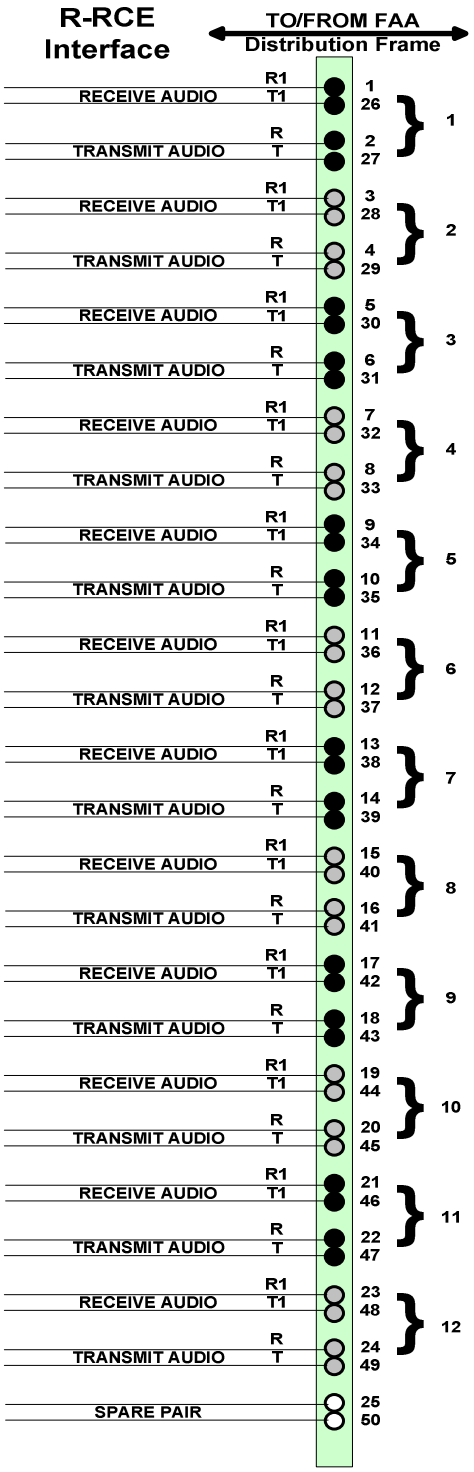

FIGURE 3-15 AVN to R-RCE Interface Pin Assignments

3.3.1.6.3 AVN to Network Radio Interface Wiring

TBD

3.3.1.6.4 AVN to Remote Monitoring and Control Interface Wiring

To be determined at site survey

3.3.1.6.5 RRN to C-RCE Interface Wiring

To be determined at site survey

3.3.1.6.6 RRN to Legacy Radio Interface Wiring

To be determined at site survey

3.3.1.6.7 RRN to Network Radio Interface Wiring

TBD

3.3.1.6.8 RRN to Remote Monitoring and Control Interface Wiring

To be determined at site survey

3.3.1.7 Electrical Power/Electronic Referencing (Grounding)

a. The NVS **must** comply with the electrical power/electronic referencing (grounding) requirements for all radio subsystems interfaces at the FAA Distribution Frame in accordance with FAA-G-2100, paragraph 3.3.5.1.1.b.

3.3.1.8 Fasteners

a. The NVS **must** comply with the hardware requirements for all connector fasteners of the radio subsystems interfaces at the FAA Distribution Frame in accordance with FAA-G-2100, paragraph 3.3.1.5.3.

3.3.1.9 Electromagnetic Compatibility

a. The NVS **must** comply with the electromagnetic compatibility requirements for all radio subsystems interfaces in accordance with FAA-G-2100, paragraph 3.3.2.d.

4. QUALITY ASSURANCE PROVISIONS

Compliance with the requirements stated in this IRD are deemed met when all the requirements specified in a paragraph are verified by one or more of the methods outlined in the subsequent subparagraphs. The results of the verification activities **must** be expressed as either pass or fail.

4.1 General

Interface requirements imposed by section 3 of this IRD **must** be verified by use of the verification methods specified in paragraph 4.5.2 and at the verification levels (phases) specified in paragraph 4.5.1. Verification methods and levels **must** be applied in accordance with Table 4-1, Verification Requirements Traceability Matrix (VRTM).

4.2 Responsibility for Verification

The program manager for the less mature voice switch has the responsibility for the interface requirements verification. The program manager for the more mature voice switch will assist in the verification.

4.3 Special Verification Requirements

This IRD imposes no special test equipment requirements.

4.4 Verification Requirements Traceability Matrix

Verification **must** be in accordance with Table 4-1, Verification Requirements Traceability Matrix (VRTM).

TABLE 4-1 Verification Requirements Traceability Matrix

(Verification Methods: D - Demonstration, I - Inspection, A - Analysis, T - Test, X - Not Applicable)

Section 3	Requirements	Verification Phase and Method			
		Sub-system Level	Integration Level	Site Level	Remarks
TBD					

Section 3	Requirements	Verification Phase and Method			
		Sub-system Level	Integration Level	Site Level	Remarks

4.5 Verification Levels and Methods

The levels and methods of verification appropriate for use in the VRTM, presented in Section 4 of the IRD, are defined in the following paragraphs.

4.5.1 Verification levels

There are three verification levels that can be used during the verification process. Verification levels are:

a) Subsystem Level. This level of verification is usually accomplished at the contractor's facility and culminates in the formal acceptance of a contractual end-item.

b) Integration-level. This level of verification is conducted at the FAATC, or at a key site. The verification conducted will determine if the hardware, software, or subsystem to be deployed for site installation will perform in a NAS environment and in accordance with NAS system-level operational and functional requirements.

c) Site-level. This level of verification is usually performed at the designated site. The verification portion of the subsystem installation and checkout will emphasize demonstration of the overall system performance requirements. It includes the demonstration of an end-item, subsystem and/or system, the final acceptance demonstrations, and commissioning activities.

4.5.2 Verification Methods

There are four verification methods that can be used at any of the three verification levels. Verification methods are:

a) Inspection. Inspection is a method of verification to determine compliance without the use of special test equipment, procedures, or services, and consist of a non-destructive static-state examination of the hardware, software, and/or the technical data and documentation.

b) Test. Test is a method of verification wherein performance is measured during or after the controlled application of functional and/or environmental stimuli. Quantitative measurements are analyzed to determine the degree of compliance to the success criteria stipulated in the IRD or project specification. The process uses standardized laboratory equipment, procedures, hardware, and/or services.

c) Demonstration. Demonstration is a method of verification where qualitative determination of properties is made for configuration items, including software, and/or technical data and documentation measured, in a dynamic state.

d) Analysis. This method of verification consists of comparing hardware or software design with known scientific and technical principles, procedures, and practices to estimate the capability of the proposed design to meet the mission and system requirements. When certain elements of design are comprised of previously qualified elements such as commercial off the shelf (COTS) equipment, then analysis of previous qualification testing in meeting specification requirements may be used to reduce the amount of qualification testing.

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5. PREPARATION FOR DELIVERY

This section is not applicable to this IRD.

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6. NOTES

This section is used to describe the unique operational concept and provide additional detail to aid in understanding the NVS to Radio Subsystem interface.

6.1 Definitions

Air/Ground (A/G) Communications: Two-way half-duplex line-of-sight broadcast radio communications on VHF AM bands (for civil aviation) and UHF AM bands (for military aviation) between ground-based personnel (air traffic controllers, flight service specialists), and aircraft.

Air/Ground Frequency: A specific two-way A/G communications channel implemented on a UHF or VHF RF carrier of a specific frequency.

Air Traffic Control: The maintenance of safe, orderly, and expeditious flow of air traffic.

Backup: Provision for an alternate means of operation in case the primary means is not available.

BUEC (Backup Emergency Communications): A secondary backup A/G communications network that is independent of primary A/G communications transmission paths and equipment. BUEC is not the same as the backup A/G switch.

Channel: A communication path providing full duplex transmission between two terminations. It provides the capability to transmit and receive voice and radio control signals for up to two Air Ground radio frequencies over a single four-wire voice grade transmission path. One frequency at a time may be controlled, or both frequencies may be controlled simultaneously.

Circuit: A conductor or system of conductors through which an electrical current is intended to flow. (2) A printed circuit electronic card containing or performing multiple electronic functions.

Configuration: The arrangement of a computer system or network as defined by the nature, number, and the chief characteristics of its functional elements. The functional or physical characteristics (or both) of systems hardware/software

Connectivity: The presence of a complete circuit or connection among stations or facilities.

dBm: Signal power expressed as decibels with respect to one milliwatt.

dBm0: Signal power in dBm referred to or measured at a zero transmission level point (TLP).

Decibel (dB): A logarithmic measure of the ratio between two powers. $dB = (10) \log (P_2/P_1)$

Facility: The total plant (e.g., building, structure, enclosure, assembly, Open-Air Plan "site") required for a subsystem/equipment item to function. The facility houses, supports, and protects the subsystem/equipment item. Facility characteristics are determined by the total complement of dependent subsystems/equipment item.

Frequency: A part of the radio spectrum used by the FAA to carry communications between controllers and pilots. The spectrum contains ultra-high (used for military air traffic) and very high frequencies (used for civilian traffic).

Frequency Pair: A combination of VHF and UHF frequencies used as a single radio communication channel.

Main/Standby (M/S) Select: The operator-initiated selection of a main or standby radio unit (transmitter or receiver). Main and standby units are functionally identical.

Push-To-Talk (PTT): A switch or similar device that activates communications resources (A/G radio transmitters or G/G channels) for transmission; the signals or logical states associated with a PTT device.

Receiver: An electronic device that detects and demodulates radio transmissions on specific frequencies. The FAA normally uses fixed-frequency remote receivers in the UHF and VHF bands, however tunable radios were used for legacy back-up emergency communications (BUEC) (e.g. pre-RCE BUEC implementations).

Remote Muting: Muting of receivers for selected frequencies. The NVS will not receive voice from the RCE interface for frequencies on which the remote muting function has been activated.

Select: To activate a feature or to place it in use because it is required for tasks at hand (as with an A/G receiver or transmitter).

Selective Mode Operation: In this mode, a VHF and UHF assigned to a sector are combined on one trunk. The controller may select VHF only, UHF only, or select both frequencies simultaneously. Using this system, a controller keying one frequency (VHF or UHF) denies the other frequency (UHF or VHF, respectively) to another controller.

Signal Ground: An electronic single point ground.

Split Mode Operation: The VHF and UHF frequencies of the sector are carried on two different trunks. Thus, there is no contention; PTT lockout affects only the selected frequency.

Squelch Break: When a radio frequency input signal level to a receiver is strong enough to be passed through to the desired audio path.

Subsystem: A set of one or more computers, associated software, peripherals, terminals, human operators, physical processes, information transfer means, and so on that forms an autonomous whole capable of performing information processing and/or information transfer.

Test Tone: A tone sent at a predetermined level and frequency (typically -8 dBm at 1004 Hz -- one way transmission) through a transmission system to facilitate alignment of the gains and losses of devices in the transmission circuit.

Transmission Level (TL): At any point in a transmission system, the power (in dBm) that is measured at that point when a standard test signal is transmitted at some point chosen as a reference.

Transmission Level Point (TLP): A point in a transmission system at which the ratio, in decibels, of the power of the test signal at that point to the power of the test signal at a reference point, is specified.

Note: A 0TLP is an arbitrarily established point in a communications circuit to which all relative levels at other points in the circuit are referred. Very often the measured power level at a point, expressed in decibels relative to a reference, is so closely associated with the point (place) in the circuit that the power level and the point are used interchangeably.

Transmitter: An electronic device that modulates, amplifies, and transmits audio signals on radio frequency carrier waves.

Transmission Path: (1) A single communications transmission path connecting two or more stations or facilities, such as a leased telephone, microwave, fiber optic, satellite, channel either analog or digital. (2) A transmission path using satellites for all or part of the path. (3) A communications channel between two switching systems. (4) A four-wire circuit that can be a leased or a Government owned transmission facility connecting the control facility RCE with a remote site RCE.

Trunk: A communication channel between two switching systems. A two-wire or four-wire circuit that can be a leased or a Government-owned transmission facility connecting the NVS with external or remote equipment. The trunk will normally include the protection and isolation equipment when leased facilities are used. A trunk is switch-connected at both ends.

Trunk Circuit: The circuitry being controlled by the NVS to directly connect with another switching system.

Type: A particular kind, class, or group.

6.2 Abbreviations and Acronyms

0TLP	zero transmission level point
A/G	Air-to-Ground
AGC	Automatic gain control
ATC	Air Traffic Control
ATR	Antenna transfer relay
AVN	ATC Voice Node
BUEC	Back-Up Emergency Communications
C-RCE	Control Radio Communications Equipment
dB	Decibel
dBm	dB above 1 milliwatt (mW)
dBm0	dB at TLP
EUROCAE	European Organization for Civil Aviation Equipment

FAA	Federal Aviation Administration
FAATC	FAA Test Center
FTI	FAA Telecommunications Infrastructure
Hz	Hertz
ICD	Interface Control Document
IRD	Interface Requirements Document
IP	Internet Protocol
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
LAN	Local Area Network
mA	milliamp
mbps	mega-bits per second
ms	millisecond
M/S	Main/Standby
mW	milliwatt
NAS	National Airspace System
NC	Normally Closed
NO	Normally Open
NOCC	National Operations Control Center
NVS	NAS Voice System
OT&E	Operational Test and Evaluation
PTT	Push-to-Talk
R-RCE	Remote Radio Control Equipment
RCE	Radio Control Equipment
RF	Radio Frequency
RRN	Remote Radio Node
RX	Receiver
SDP	Service Delivery Point
SIP	Session Internet Protocol
SQB	Squelch Break
Stby	Standby

TX	Transmitter
uA	microampere
UHF	Ultra High Frequency
VAM	Versatile Alarm Monitoring
VDC	Volts direct current
VG-6	Voice grade 6
VHF	Very High Frequency
VOX	Voice Activated Circuit
VRTM	Verification Requirements Traceability Matrix

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